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TECH JOURNAL

THE dBASE II UNIVERSE

TECHNICAL TIPS FOR IBM PC PROGRAMMERS

dBASE II FILE STRUCTURES

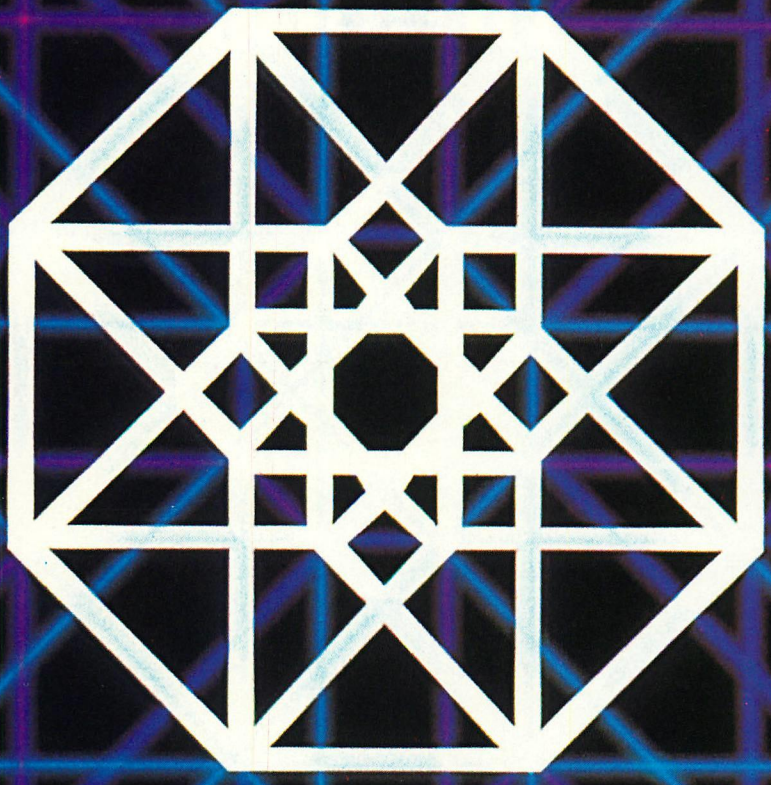
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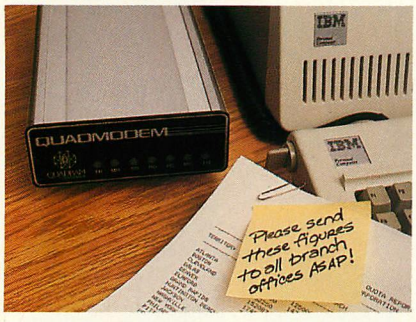
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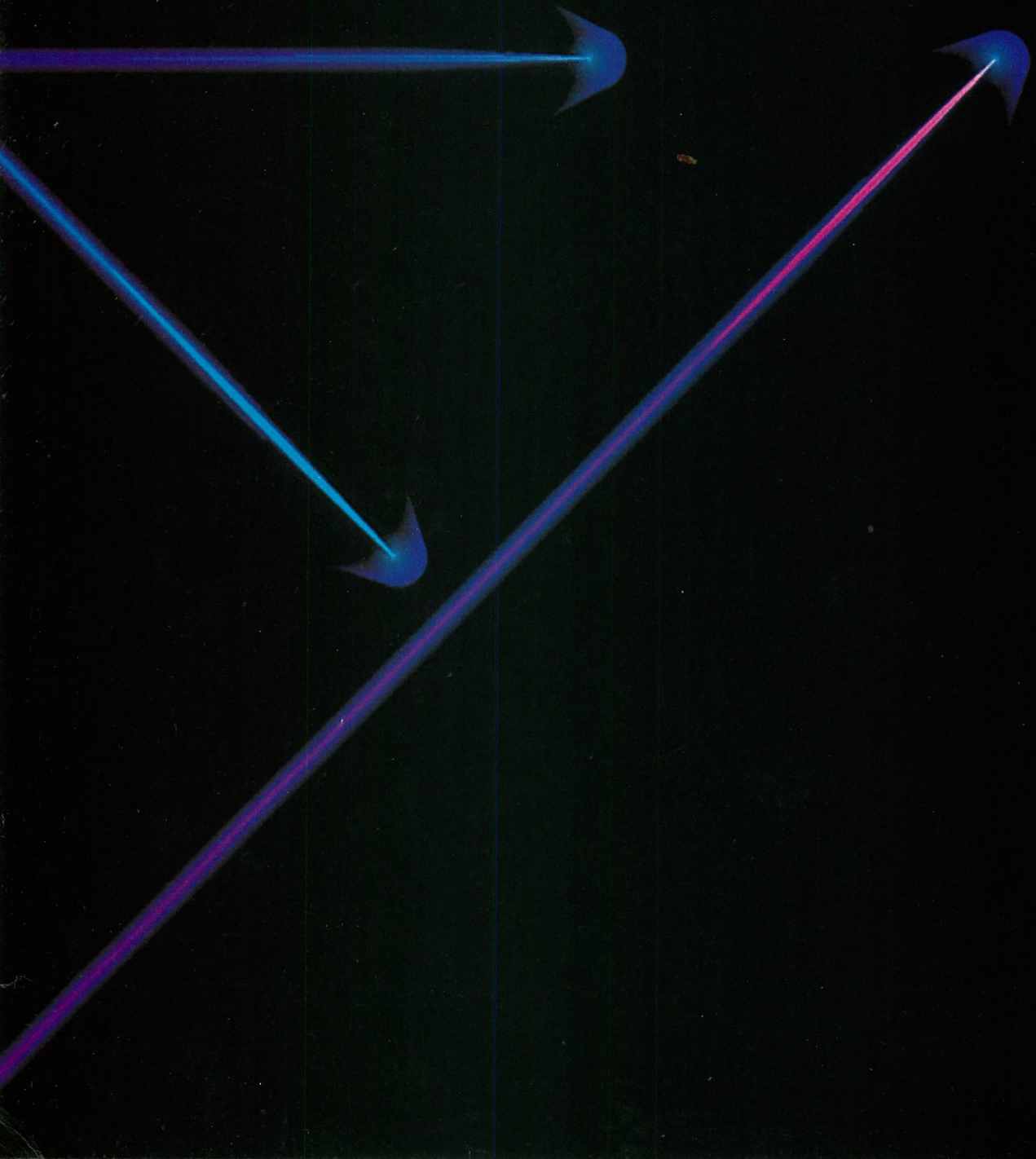
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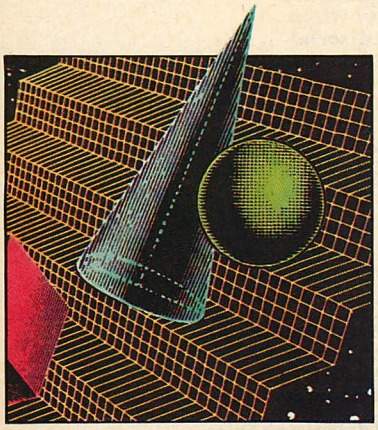
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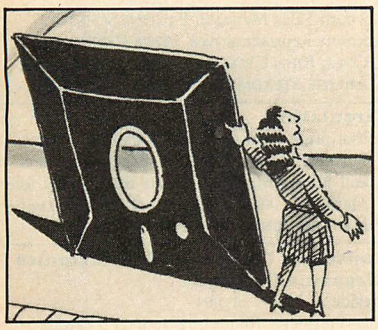
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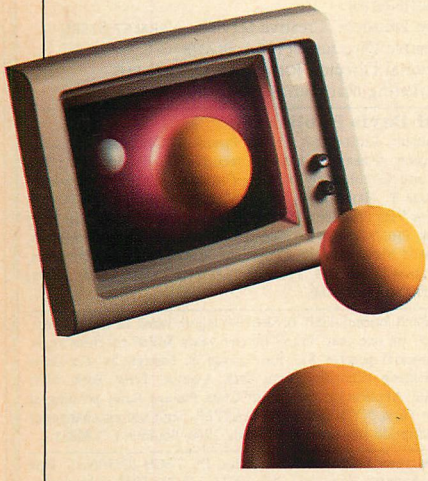
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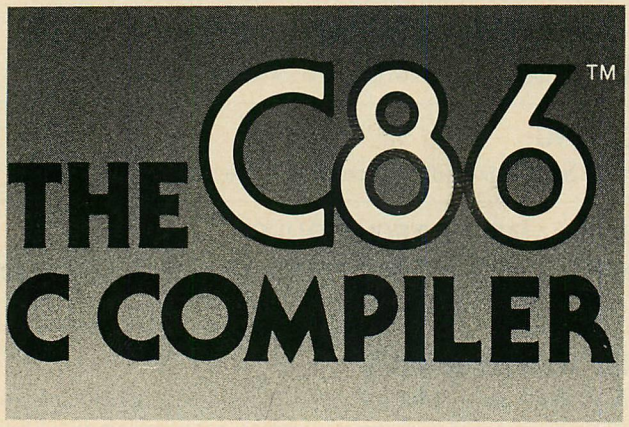
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BPA

dBASE II Hangs On

In the face of mounting competitive pressures, dBASE II still sells well

WILL FASTIE

When the IBM PC was introduced, there were three big software packages: VisiCalc, WordStar, and dBASE II. These programs were at the acme of their respective categories: spreadsheet calculators, word processors, and data managers. Nothing could touch them from the standpoint of sales volume, and little could touch them from the standpoint of functionality within their particular categories.

The IBM PC heightened, if anything, the desirability of these software products. The biggest question after August 12, 1981, was how soon the other two packages would be ready for the PC; VisiCalc, of course, was ready that day.

We can learn much from what happened within two of those categories—spreadsheets and word processing—in terms of what the future might hold for dBASE II.

SPREADSHEETS

VisiCalc was king of the heap when the PC was announced. Already, however, another program was becoming a major contender: SuperCalc. Its claim to fame was CP/M compatibility, a factor that gave it access to a far wider installed-hardware base than that of Apple and Radio Shack combined, which was VisiCalc's natural habitat.

Once the PC was out, VisiCalc tarnished rapidly. Not only did a SuperCalc conversion get started and become available quickly, but two other events conspired to topple the program that many thought sparked the micro revolution. First, Microsoft announced MultiPlan, the first of its Multi-Tool series. Second, and most devastating, Lotus introduced 1-2-3 with a media blitz that sent computer owners everywhere scurrying for the cover of a computer retailer.

In the Lotus onslaught, SuperCalc³ has held its own, but every other package has suffered. Numerous other companies have offered integrated packages including Spreadsheets, but none has caught on.

It brings a tear to my eye to say this: VisiCalc is near death. It needs a major overhaul to achieve better graphics integration, better consolidation, and better performance. Without these features, VisiCalc simply cannot compete in modern times. VisiCalc IV is too little, too late. My tear is shed out of sadness that the creators of the most important computer application in the last ten years have lost their competitive edge.

What wounded VisiCalc so mortally was the speed with which the competition took full advantage of the new hardware technology represented by the IBM Personal Computer and other 16-bit machines.

WORD PROCESSING

Like VisiCalc, WordStar was the undisputed ruler of the pre-IBM world. Although word processing, unlike spreadsheet calculators, was not a new application, WordStar brought most of the functions of dedicated word processors to small microcomputers. The cost differential was not lost on a horde of professionals, who quickly made WordStar a hot seller.

IBM's introduction of EasyWriter for the PC was met with almost total derision, and again the question on everyone's lips was when MicroPro would introduce the PC version of WordStar. The company did, and since that time, through successively improved revisions, WordStar has been a strong seller. It continues as such today.

However, the veteran WordStar has been slowly gaining serious competition from an army of new entries in the marketplace, most significantly, WordPerfect and MultiMate. This array of products is beginning to take its toll, although WordStar's health remains good. MicroPro even managed to snag a contract recently with IBM Japan, which is private-labeling WordStar, SpellStar, and MailMerge for the IBM 5550, Japan's version of the PC!

WordStar addicts are not impressed by the features and facilities of other contenders (they might say pretenders) for the WP throne. For them, WordStar is it, and they continue to win converts. But a serious look at the other products reveals considerable strength, and it is a sure bet that MicroPro's market share is not what it once was.

WordStar has moved into middle age without contracting any of the

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fatal diseases that struck VisiCalc. It seems to be in perfect health. We might suspect, though, that it is afflicted with a touch of high blood pressure and a gray hair or two as it maintains its fighting status in the high-stakes 16-bit world.

Data Management

dBASE II was also long-awaited after the announcement of the PC. And because information management was a priority for the PCs flooding into corporate America, boom times struck Ashton-Tate.

dBASE II remained just about the only large-scale data manager available for the PC for quite a while. Only recently has the product been seriously threatened. Strangely enough, the veritable army of products in this category (*PC Tech Journal* has received for review more than 30 products claiming to outstrip dBASE II) has not shaken the market so violently that dBASE II has been dislodged from its throne. What makes this peculiar is that some of the competition is very good.

There are a number a reasons why dBASE II is having such a vigorous middle age. Despite many faults, it is a competent implementation. Although it does not really bring "370" power to the micro (as earlier Ashton-Tate ads would have had us believe), dBASE II certainly brings sufficient functionality and capability to handle 90 percent or more of anyone's data management problems. Couple that functionality with a programming facility that is really quite straightforward and you have a winner—a powerful and accessible tool.

Furthermore, dBASE II has spawned its own aftermarket, something few products can claim. A wide array of support tools, utilities, and dBASE II enhancers are available to dBASE II application developers. In fact, it is the aftermarket that provides the *raison d'être* for this issue of *PC Tech Journal*.

dBASE II probably attained its position of strength by virtue of being first and delivering significant functionality. That, the existence of the aftermarket, and the growing body of people able to program in dBASE II have kept the product strong. Unless Ashton-Tate has something up its sleeve, that now is almost certain to change.

From VisiCalc and WordStar, we learn that being first is a great advantage. We also learn that it is a great risk; the competition is very, very good once they see the new idea.

Ashton-Tate's competition is very, very good. Sixteen-bit architectures and large main memories make the addition of significant new features, functions, and performance not only possible, but sometimes easy. The competing products offer more bang for (almost always) fewer bucks, and the competition is aggressive about telling us that.

The greater power of today's desktop computers is spawning data management products of a completely new genre (see "Database Systems Are Complex," *PC Tech Journal*, February 1984 and "New Wave Database," *PC Magazine*). They are easier to use, harbor powerful file-system implementations, and are rich in features. Many do not require programming in the traditional sense, and yet they deliver what appears to be procedural functionality. Increasingly, these products are being aimed at the end user rather than at the sophisticate who is able to program.

The serious competition is just beginning to emerge in the data management field. dBASE II still has a firm grip on the market; how shaky that grip becomes depends largely upon Ashton-Tate's skill at dealing with the flood of competent, powerful, and slick competitors. VisiCalc didn't fare so well. WordStar is not as invincible as it once seemed. There are at least two and perhaps three times as many competing data management products as there were spreadsheets or word processors.

How will dBASE II do? Time will tell.



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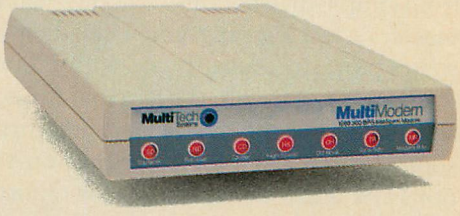
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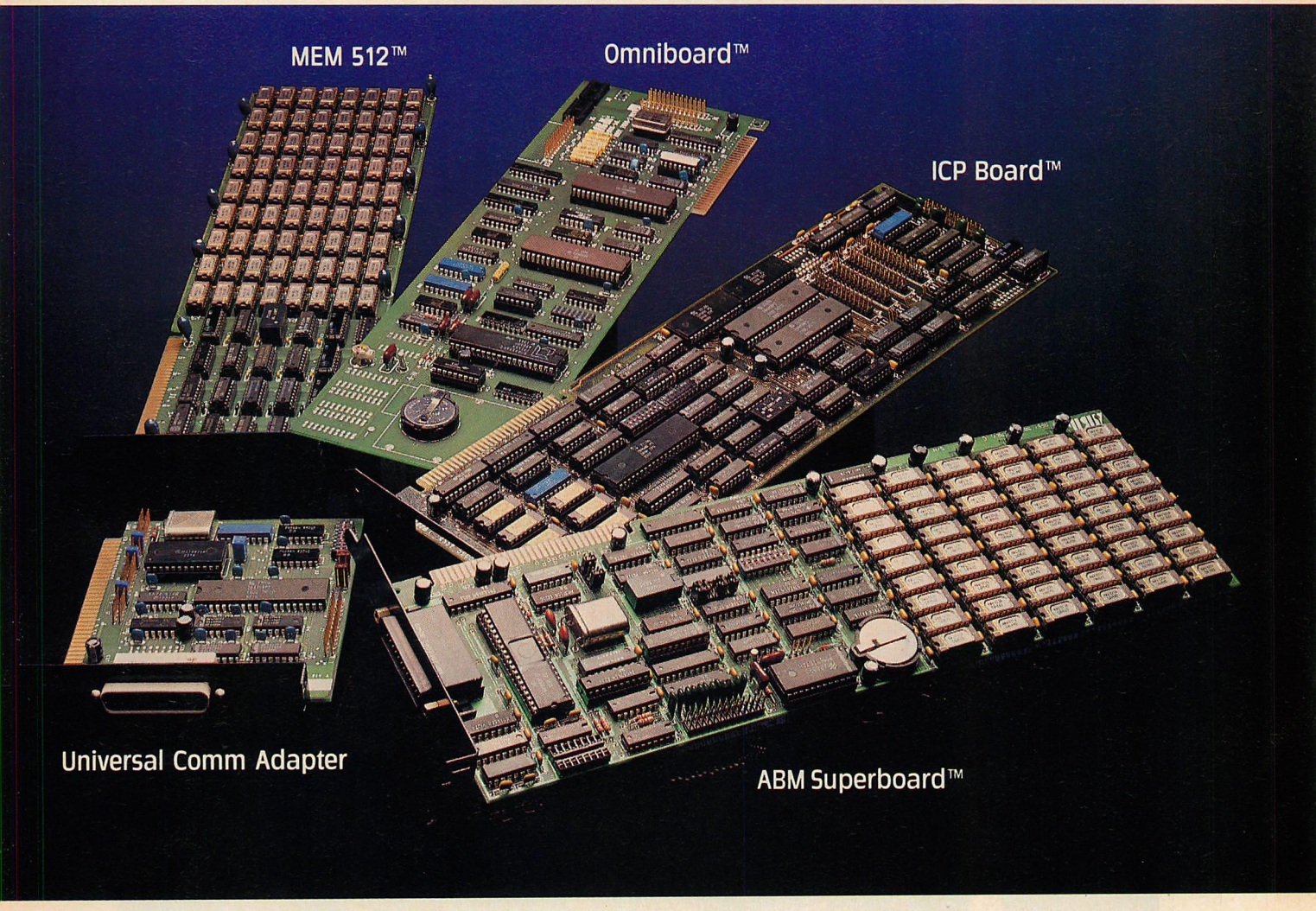
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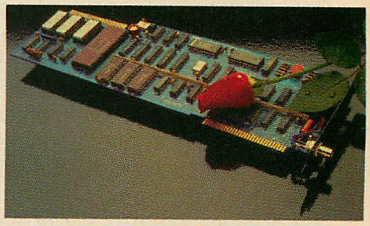
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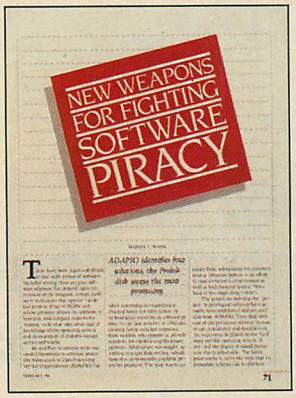
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PROLOKS AND PANACEAS

I am writing in response to an article in *PC Tech Journal*, "New Weapons for Fighting Software Piracy" (Feb. 84). The article described in some detail a product called the Prolok Disk. While I thought the article was very accurate, I found one significant point in error, and I think it should be corrected for your readers.

I personally think the Prolok Disk is an excellent product. It addresses the problem of software protection in a unique manner that has advantages over previous software protection schemes. The advantages I like best are that it can be copied with standard disk copiers as many times as needed, and although the copies are unusable, they protect the user. A back-up can always be copied back to the Prolok Disk, which will be usable unless the diskette is severely damaged. Also, a hard disk may be used if the Prolok diskette is in the floppy drive.

Where I differ with your article is the question of security. An associate of mine, possibly the one mentioned in the article, broke the security. He was working for a company that was trying the diskette as a beta test site. The company used the diskette for a while, although apparently they are not using it now.

This is where the story changes. He broke the diskette in about two hours. The result was a standard diskette that would run the product on any machine. The advanced equipment he used to break it consisted of an IBM PC and the PC DOS DEBUG program. While my friend is far from ordinary, I doubt that there aren't hundreds of programmers as capable. I also doubt that the average computer programmer would succeed in breaking the diskette.

While the Prolok Disk has a lot of merit as a protection device, it is not a panacea. I don't feel that software publishers should be deluded into thinking it more secure than other available methods.

Mitchell Schoenbrun
San Francisco

I am both a producer and user of software, and I read with some interest the article on software protection (March 84). While your discussion of the general problem was valid, your proposal would cause far more problems than it would solve. How, for instance, would the serial number validation work on a LAN terminal? Would I be compelled to keep a separate copy of the program for each terminal? If so, much of the operational efficiency achieved by LAN would be nullified, to a point where I would not purchase or use such a product. In fact, I do not knowingly buy any copy protected software, so the net result is protecting the producer from any sale to me.

I believe a far better approach is to treat software as another branch of the publishing trade, with the same general rules and procedures. There have been any number of books containing program source code to be copied into the reader's machine. Neither the authors nor the publishers appear to have suffered greatly by the circulation of copies of these programs. In fact, such circulation may have spurred sales, since the documentation is rarely included with the copies and is easily and inexpensively obtained by buying your own copy of the book. One-line command utilities may be used without much support, but the more complex programs require some sort of manual to use effectively. In other words, sell the book and give away the disk. Could the book be copied? Sure, but if the selling price of the book were less than the copy cost, to what advantage? What about $500 programs? Sell them for $50 or less. I suspect the market for $50 programs is more than ten times greater than the market for $500 programs. By taking advantage of the mass marketing and distribution techniques already in use by every book publisher, the production and distribution costs are reduced to levels that will assure a profit to all parties.

I really think that oddball disk formatting, serial number checking, stickers on the cabinet, and threatening licensing agreements are both unnecessary and counterproductive for the general run of commercial software. Neither do we need new laws to clutter things up; the ones we have will work just fine if applied with a modicum of intelligence and common sense—though I realize those are in short supply among

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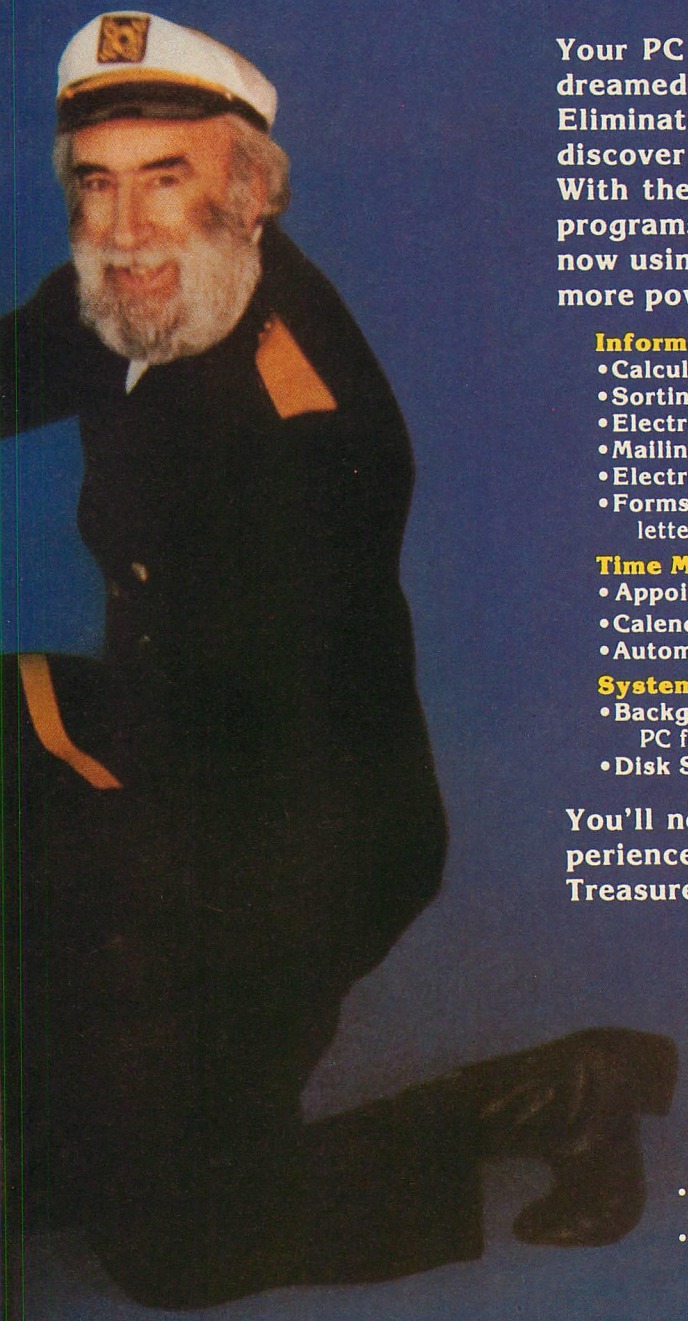
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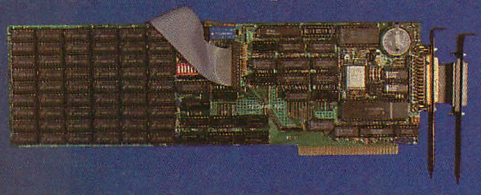
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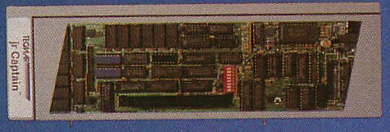
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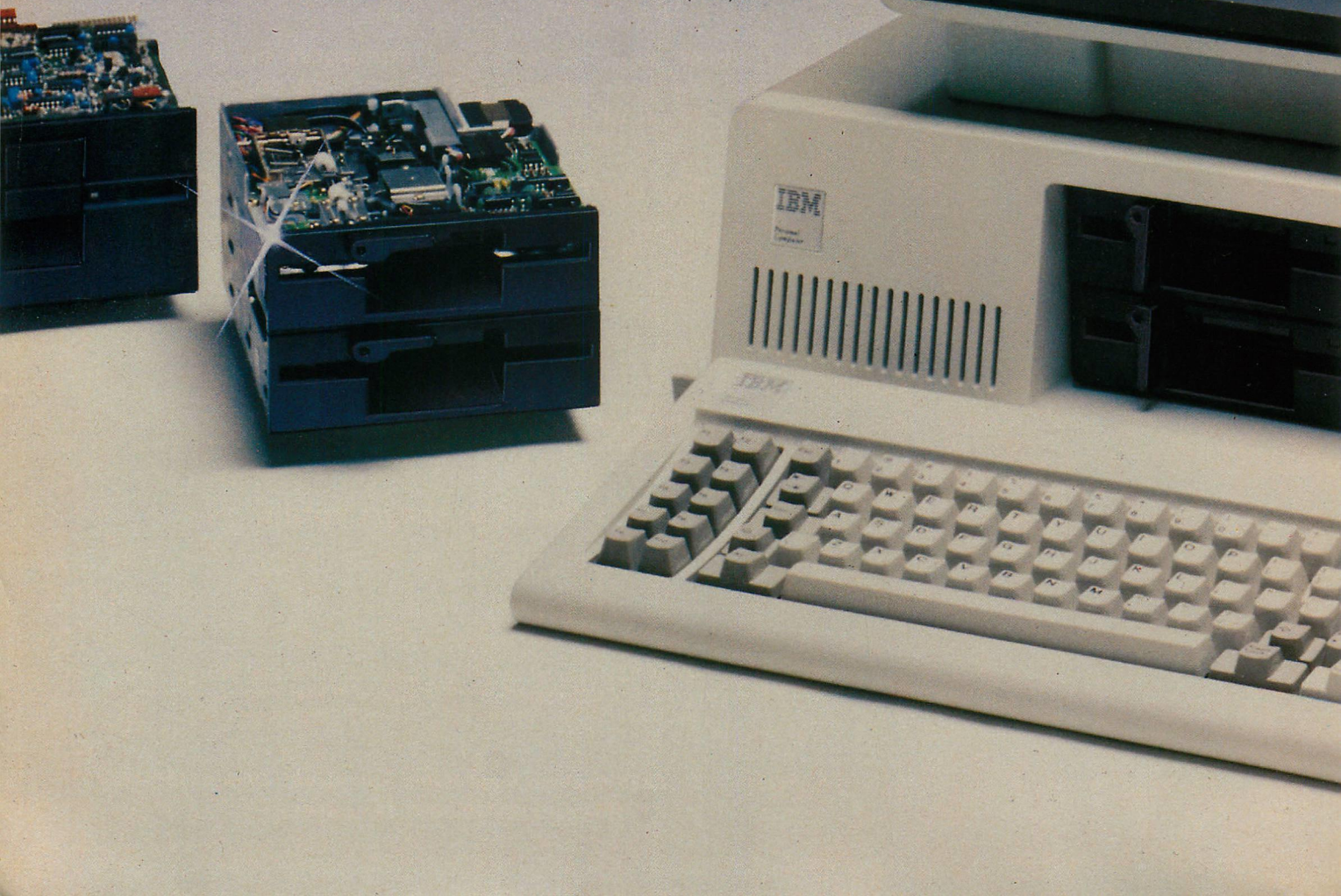
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Ralph D. DeCamp
Middletown, NJ

The Truth about Truth

In a recent Tech Notebook ("The Truth about BASIC," Jan. 84), the author presented a method of evaluating true/false conditions to replace IF . . . THENs. While he does mention the drawback of illegibility when later returning to the statement, he fails to mention the price that one pays in program speed. Since the statement is fully executed on every pass through the loop, in the worst-case example of the condition always being false, the loss of time is 33 percent. In the best-case example of the condition always being true, his program runs a mere .5 percent faster. Therefore, if speed is any factor in the program you are writing (have you ever written one in BASIC where it wasn't?), the more legible IF . . . THEN is clearer and almost always faster. This, of course, goes against the grain of all those pure programmers who seem to love elegance and recursion even more than Mr. Hoare himself.

Phil Daley
Amherst, NH

Patch to AP80.COM

I found the review of the IBM and STSC implementations of APL (Nov/Dec 83) to be very helpful. I've been using the IBM version and am generally pleased with its performance.

One of the unfortunate features of the IBM APL is that it works only with the IBM printer. However, there are ways to make it perform even without this particular printer.

If you have an Epson printer, you can modify one byte in the program AP80.COM as follows. Make a copy of AP80.COM and invoke DEBUG. Then perform the following operations:

```
-u 023a 1.2
xxxx:023a   MOV DL,59
-e 023b
xxxx:023b          59.4c
-w
-q
```

This new version of AP80.COM will print most of the APL characters on the Epson. This patch first appeared in an article by Wes Lewis, volume 2.10 of *Personal Computer Age*.

If you have a C. Itoh Prowriter, life is even easier. Courtrin Enterprises, P.O. Box 23110, San Diego, CA 92123, now offers a program called ProAPL that will solve your problems. You simply load ProAPL at the start of the session, and from then on all APL characters are printed out with no problem on your Prowriter printer. This program is offered as part of a package of utilities for the Prowriter printer that allows it to simulate nearly all functions of an Epson printer. The cost of the entire package is $34.95.

I should mention that the folks at Courtrin developed the ProAPL package at my request; but I'm sure that other APL users will find it useful. Such a responsive company certainly deserves user support.

Hal R. Varian
Ann Arbor, MI

ISO Zeus

The December 1983 *PC World* contained an article titled "In Search of the Hypothetical Zeus," in which the magazine discussed the need for "a board that can display text and graphics on a monochrome or color monitor with complete software transparency." Claiming such a board didn't exist, they then reviewed the Hercules Graphics Card, Orchid MGA, and Tecmar Graphics Master. Since ads for boards claiming "Zeus" features had been appearing for two months at that time, I wrote *PC World* scolding it for not even mentioning such boards.

Their oversight notwithstanding, since early January I have been the pleased user of an STB Graphix Plus, running unmodified graphics software on my monochrome monitor. When I saw your March 1984 article, "Graphics on the IBM Monochrome Display," I thought some periodical had finally realized the existence of such boards. Instead, I got a review of two of the boards *PC World* had covered three months ago, and the second paragraph would lead people to think that Zeus features are still unavailable. Since I feel that such boards are, for most monochrome users, the best means available to have a beautiful character set and graphics, I feel your failing to even mention them constitutes a severe disservice to your readers.

Donald S. Schmick
Atlanta

You are absolutely correct. I ask for your understanding of two simple facts: we can't know it all, and we can't always know what tomorrow will bring.

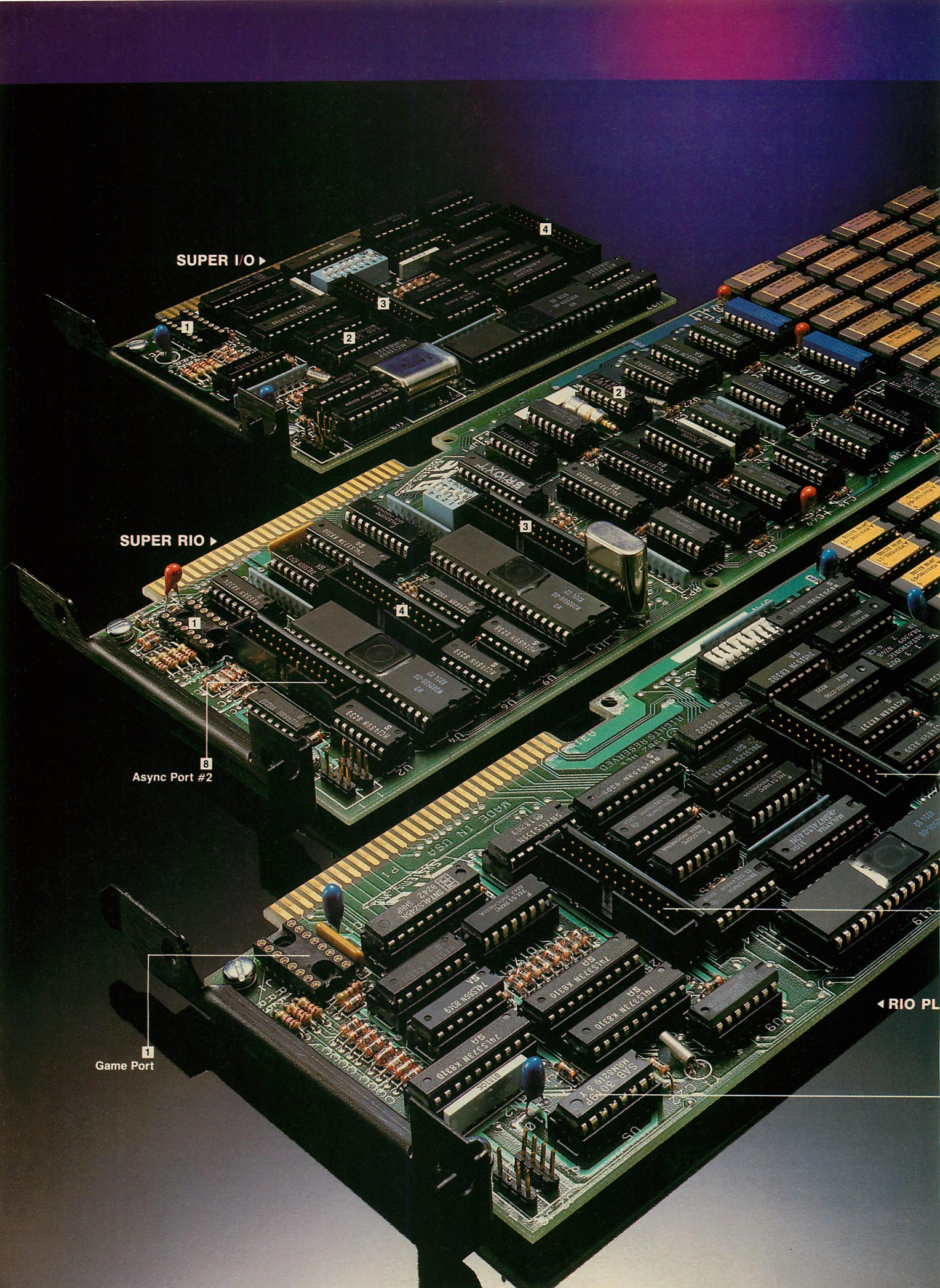
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We all hope that our good works outweigh our missteps, and we rely on readers like you to keep us alert.

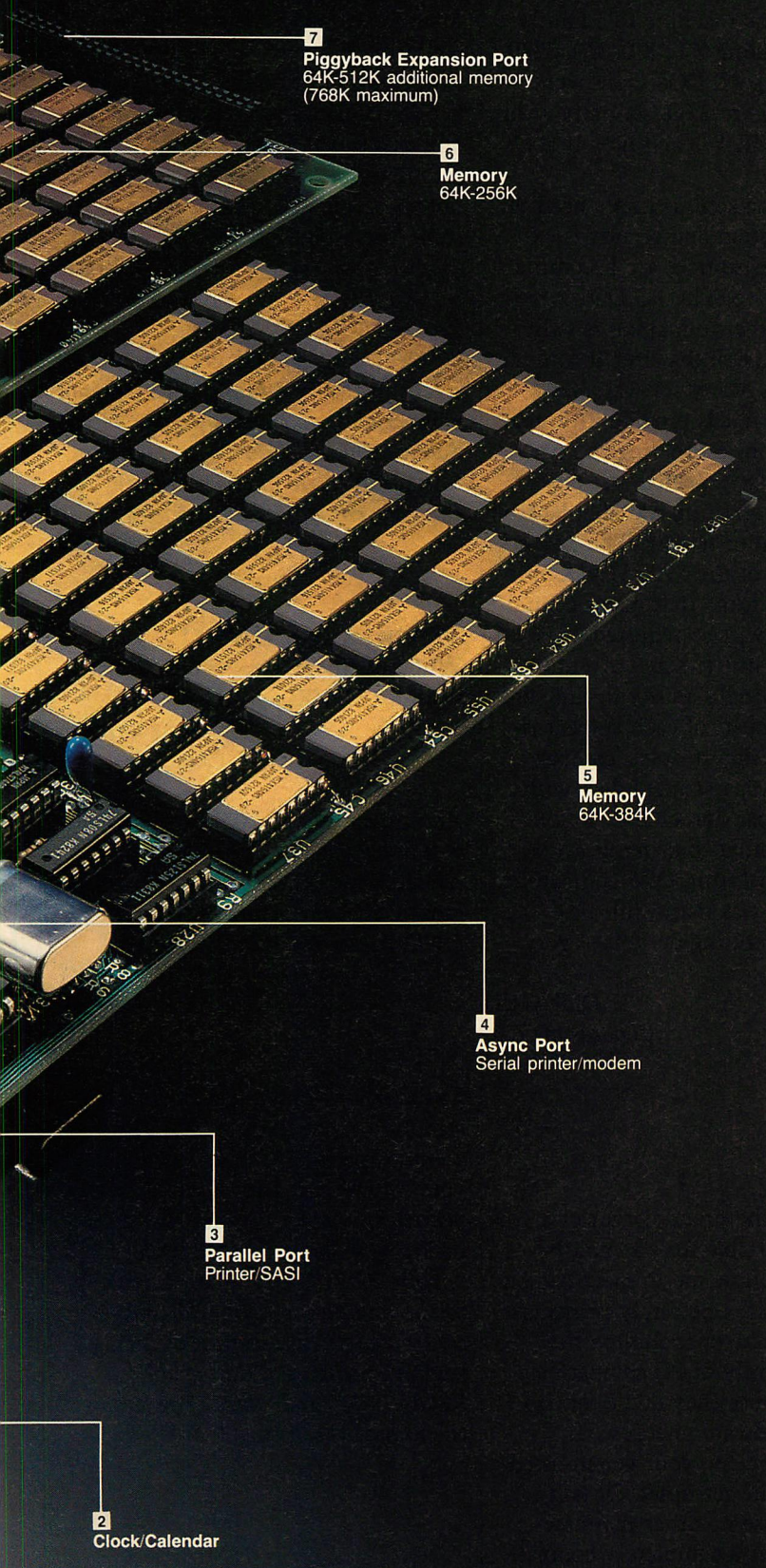
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PC Tech Journal's insistence on "exacting, professional coverage" (Directions, Jan. 84) has made it the proven voice of reason in the fast-growing IBM-related industry. Your decision


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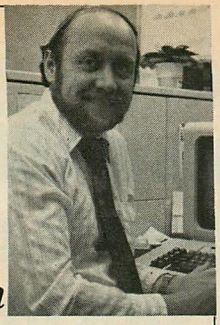
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CIRCLE NO. 199 ON READER SERVICE CARD

How Dan Feeney Made The Micro To Mainframe Connection



Dan Feeney, systems manager at **Alumax Mill Products** in Morris, Ill., decided that line charges on one of his IBM model 12 terminals were too high. His firm's corporate headquarters in Chicago was using it to print sales and price reports from the plant's S/34 in Morris and to do online financial modeling.

A PC, Dan reasoned, could do the modeling with any one of the spreadsheet programs available and the reports could be "bicycled" the 50 miles to Chicago. Dan had the terminal removed and bought a PC. The executives were initially pleased with the new system.

"After a period of time the Chicago management missed the communications with the plant," Dan said, "Each week there's a deadline and they must have the reports the same afternoon we produce them. Couriers just couldn't get the reports there in time."

Dan began to question his prior decision to get rid of the headquarters terminal. He looked around for a way to restore communications without having to put the terminal back in. After looking at what was available, he decided to try the BLUE LYNX package.

"It worked the first time we tried it," Dan said, "and we haven't needed any service calls since we've had it in."



Phone line costs are minimal for the BLUE LYNX equipped PC when compared to the charges on the model 12 that was previously in the headquarters office. Also, the total cost of the PC with BLUE LYNX was much cheaper than that of the terminal and printer. Seven hours a day the PC is now off-line running the spreadsheets. The on-line report printing takes only a short time with a 2400 baud rate running over switched lines.

IBM 5251/12 emulation for S/34, S/36 and S/38 users. **IBM 3276** emulation - SNA/SDLC or Bisynch $690 complete. Combination of 2 emulators $1230. **VTERM - DEC VT100/52** emulation software package (requires IBM Adapter) $125

TECHLAND
SYSTEMS INC.
(212) 684-7788
25 WATERSIDE PLAZA, NEW YORK, NY 10010
BLUE LYNX 5251 is a joint development of Software Systems, Inc. Jefferson City, Missouri & Techland 5/84

CIRCLE NO. 156 ON READER SERVICE CARD

LETTERS

to switch to monthly publication came none too soon.

During 1983, the PC family grew from one machine to a family of five (including XT, XT/370, 3270 PC, and PC*jr*). PC DOS underwent a major upgrade to 2.0 essentially abandoning the 64K PC, and now it is already at 2.1.

Just as the serious user's need for good information and reports is exploding, other sources are becoming more restrictive. The PC DOS 2.1 technical reference manual is still not available, months after the announcement. Many software and some hardware ads provide little real information for estimating the performance to be expected, yet newer products are often unavailable locally for inspection or testing. The announcement of the $900 UNIX operating system hints that major capital investments will be required of PC practitioners just to stay current.

Tech Journal's ability to find and analyze the heart of each subject is vital. Susan Glinert-Cole's comparison of the Apparat fixed disk with the other expansion chassis options (Feb. 84) in order to bring up the software (and future DOS compatibility) issues was masterful.

We're counting on you—every month.

Dick Gall
Richardson, TX

Thanks.

—WF

IBM ONLY

I have been the proud owner of a Columbia Portable for six months now. Please allow me to speculate on why your magazine rarely prints articles about and/or including the Columbia family of PC compatibles.

Is it because they don't contribute their hardware or software? Maybe it's because your generous advertisers might get upset. Or is it simply because no other manufacturer can offer a completely compatible computer including $1,500 worth of free software for their prices? Could it be you feel that it's immoral to underprice all the leading manufacturers and that doing so could mean economic disaster for many of your acquaintances?

Whatever your reasoning, don't you think the time has come for the public to know there is a compatible out there for half the cost and with some very good software?

Fred Tabaracci
New York City

PC Tech Journal *is devoted exclusively to the IBM family. (Clones and compatibles are covered in our sister publication,* PC.) *However, much information carried here is relevant to the very compatible compatibles.*

—WF

WHERE'S THE UNIX?

Who says there is no application software for UNIX?

Gig Graham
Cambridge, MA

Accompanying Mr. Graham's letter was a 438-page catalog of UNIX-related products published by /usr/ group: The International Network of UNIX users. We stand corrected.

—WF

Erratum: *Readers have called our attention to an error made in listings 4 and 5 (pp. 74-75) in the article "Life in the Fast Lane," which appeared in our April issue. A section of listing 4, beginning with the line "public REGCNV05" and continuing to the end of the listing, should be transposed with a section of listing 5, beginning with the line "public REGCNV04" and continuing through the end of the listing. Our apologies.*

—WF

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RANDOM RUMORS AND GOSSIP

IBM is expected to introduce version 3.0 of PC-DOS this summer. It should feature multi-tasking, windows, and some networking support. The biggest surprise about 3.0 is that IBM reportedly developed the system itself after having Microsoft develop the prior versions. This will no doubt cause problems for IBM PC-compatible system manufacturers. **Microsoft** is rumored readying a business software package for the PC (including general ledger, et al.). **Pick Systems** is expected finally to release a version of its Pick Operating System for the IBM XT that will be marketed by IBM. Developed in 1973, the Pick OS has been implemented on more than 20 different minicomputer systems and has become a popular multi-user, multi-tasking operating system. **IBM** is understood to have formed a task force with the specific objective of developing compatibility between the file systems used on the PC, System/38, and 4300/308X computer families. **Commodore** is rumored negotiating with Intel for a manufacturing license for the 8088 microprocessor IC, which would be used for an IBM-PC compatible system they are expected to introduce late this year. Commodore recently signed an argeement with Bytec-Comterm, of Montreal, for use of their Hyperion system design.

ANTI-SOFTWARE PIRACY FUND FORMED

The "Software Protection Fund" has been formed to aid in the combating of an "explosion" of illegal software copying. The SPF's goal is to "frustrate" software piracy, particulary by large companies or "national account type" users, by professional resellers, by home users and hobbyists, software rental firms and companies that "aid and abet" by marketing software-copying devices and software.

The SPF organizers include Ashton-Tate, Lotus Development Corp, Sorcim, and Microsoft Corp. The group, which already has $500,000 in contributions, expects to work closely with ADAPSO (Association of Data Processing Service Organizations) to influence government copyright law legislation. It will also "educate" to discourage copying and pursue enforcement of legal rights against pirates.

It is worth noting that Lotus recently filed a $10 million suit against a company for distributing copies of its Lotus 1-2-3 package to branch offices of the company. The copies were used internally and not offered for sale.

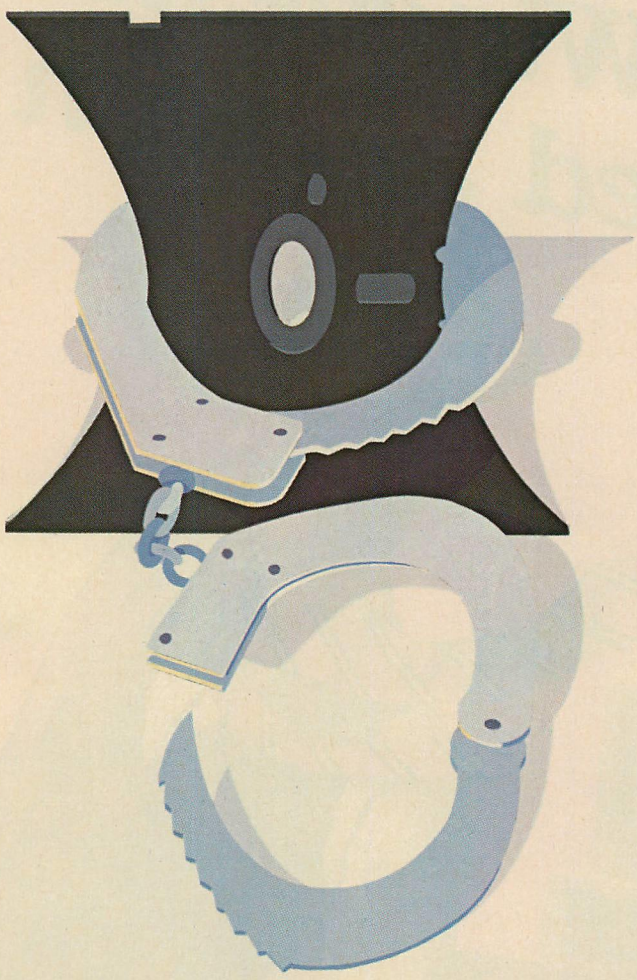


ILLUSTRATION • RICHARD OSAKA

PC*JR* GETTING COOL RECEPTION

Initial reports are that there is no shortage of IBM PC*jr*s on dealers' shelves, even though IBM is still shipping only limited quantities to dealers. IBM is reportedly spending $40 million in an effort to sell 500,000 PC*jr*'s this year. That works out to $80 per machine and therefore may be Big Blue's largest single expense on the machine.

Some dealers are expressing the view that the Apple IIe, which costs significantly less, presents a better value. Estimates are that Apple will sell more than 750,000 IIes, up from 600,000 last year. Many purchasers are comparing the PC*jr* to the new Apple Macintosh, since a comparably equipped PC*jr* is not much lower in price and lacks many of the Mac's features and performance capabilities.

Many people criticize the PC*jr*'s keyboard for its funny feel, its far-apart keys, and its hard-to-read labels. Yet IBM says it hasn't gotten any complaints from users. Others find the machine too expensive as a home machine and lacking the power needed for an office machine. IBM has its work cut out for it in trying to sell the machine. The best thing it has going for it are the three letters on its front: IBM.

PC-COMPATIBLE PRICES ARE EXPECTED TO DROP

IBM's standard PC and PC Transportable are still limited in availability, although supplies of the XT and PC*jr* appear to have caught up with demand. Industry experts are predicting that IBM's supply of PCs will catch up with demand this fall, which will probably pressure PC-compatible makers to reduce prices and bring out products with better competitive features.

THE TECH JOURNAL NEWSLINE

News, views, and gossip on the IBM and IBM-like marketplace

Thus, it is expected that the marketplace will see a 10 to 20 percent drop in prices for PC compatibles by the end of the year, and companies will also introduce new compatibles with enhanced features. The PC-compatible makers are feverishly working to lower the manufacturing costs of existing products and to economize on future designs. This generally means moving assembly and manufacturing to the Far East and Mexico. Design costs are reduced by integrating functions in custom ICs to reduce parts count.

New, enhanced designs are expected to emphasize mainly notebook-size portable PC compatibles. Units with LCD displays of 16 lines by 80 characters are expected to become available this fall, with full 25-line displays expected next year.

LOTUS ANNOUNCES 1-2-3 SUCCESSOR

Lotus Development Corporation, developer of the most successful PC applications software package currently available, has announced a new package called Symphony that they expect to start shipping this summer. Previously rumored in this column, Symphony is essentially an enhanced version of Lotus 1-2-3. The price will be $695, more than $200 more than 1-2-3, which will still be sold (there is speculation that Lotus is planning a price cut on 1-2-3). Current 1-2-3 owners can move up to Symphony for only $200. Symphony adds word processing with data base forms and mail-merge facilities, communications with auto-dial/auto-long-on and file transfer, windowing, and password protection. There has been an increase in spreadsheet size and in the number of records. In addition, new graphics options have been added, and the data base sort is now much faster. Symphony requires 320K of memory, however, compared to 192K for 1-2-3. Late this year Lotus is expected to add additional features, such as a spelling checker, to Symphony.

IBM RELEASES XENIX FOR SYSTEM 9000

IBM has begun shipping the Xenix operating system for its S9000, 68000-based series of desk-top computer systems, six months after it was announced. Xenix is the Microsoft implementation of Unix Version 7 for microcomputers. The S9000 microcomputer systems are made and marketed by the IBM Instrument Division. Using Xenix, the S9000 can handle up to four users with full multi-tasking ability. A basic S9000 system, which consists of 10Mbyte hard disk, floppy disk, 640K of RAM, and memory management, costs $16,000.

The S9000 series, which comes in two flavors, the S9001 and S9002, has been revamped to make its appearance more attractive on the office desk top. First introduced strictly as a laboratory scientific computer, it has undergone a metamorphosis into a general-purpose machine. Although still being marketed primarily as an engineers/scientists machine, it is now becoming attractive as a business office multi-user system. For example, using Xenix, the system now has features such a full-screen editor, spelling checker, text processing, typesetter formatting, bibliography generator, electronic mail, calendar-reminder service, and on-line tutorials. IBM has also begun selling two business-oriented applications packages from Ryan-McFarland.

The S9000 systems with Xenix thus appear to compete with the IBM XT with IBM's new PC/IX operating system. PC/IX, discussed in last month's column, is a single-user version of Unix System III. A four-user S9000 system looks as if it will cost significantly less than four XTs running PC/IX and it will be considerably more powerful and more user-friendly. Further, there is a distinct lack of compatibility between the systems. The S9000 is also expected to present competition to the new 80286-based multi-user, multi-processing system that the IBM Entry Systems division is expected to introduce later this year. Added to IBM's confusing Unix marketing situation is the shipping of the Berkeley version of Unix on the XT to MIT (more on this below). It will certainly be interesting to watch IBM compete with itself.

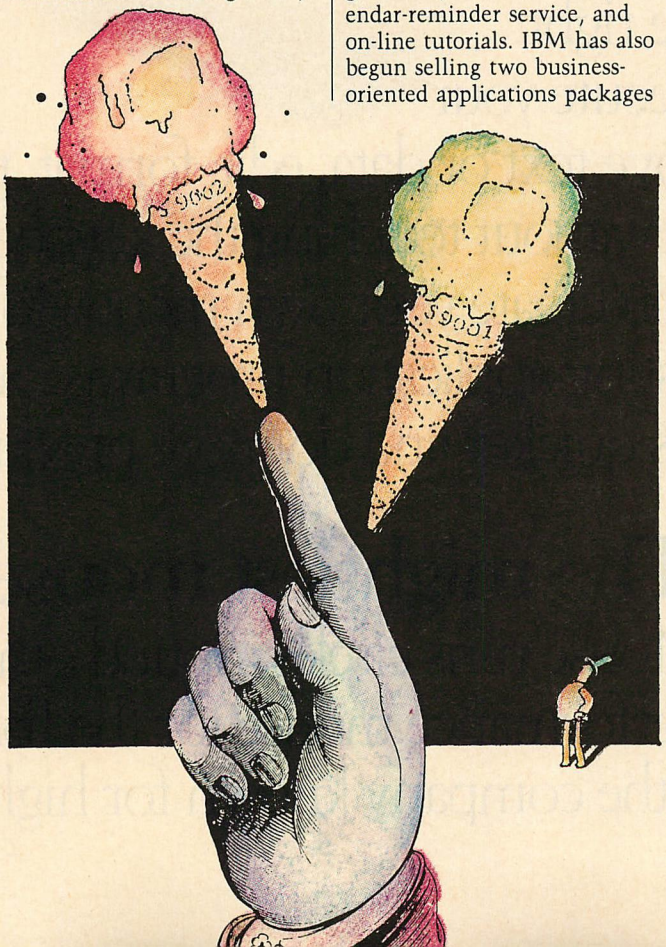


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IBM SHIPS XT'S WITH 16032 COPROCESSORS

IBM will soon ship 150 XTs containing plug-in National Semiconductor 16032 16-bit microprocessor-based CPU cards to Massachusetts Institute of Technology for use on its large networking development project (described previously in this column). The boards are made by Sritek and include the National Semiconductor floating point math coprocessor ICs. IBM will also provide its new video controller board with high density graphics capability and the Berkeley version of the UNIX operating system.

The 16032 is a 32-bit microprocessor with 16-bit I/O

Get yourself a

This little critter comes with specially-designed software that flies through the maze of keystrokes on the most popular business programs faster than you can say "cheese."

Microsoft® Mouse puts the power to run Multiplan,® Lotus 1-2-3,™ VisiCalc® and WordStar® in the palm of your hand. Click the left button on the mouse, a custom menu appears. In English, not hieroglyphics. Click the right button and execute your command: move text or data, edit, format, print. All at blinding speed without touching the keyboard.

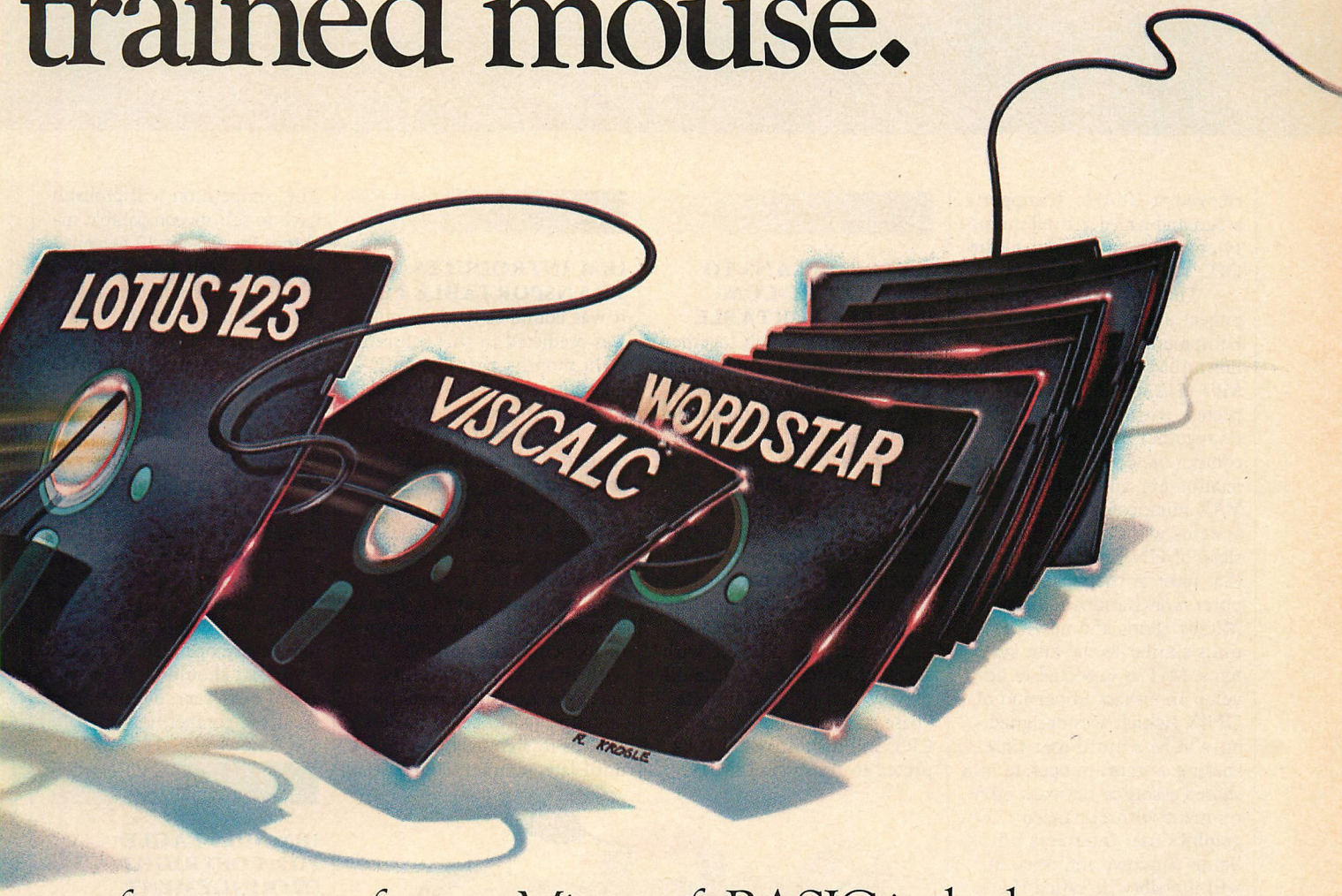


It also lets you create your own menus for editing and formatting existing application programs. So people can learn programs quicker and do more productive work as they learn.

The mightiest mouse.

Microsoft Mouse runs circles around other mice. It is the high performance mouse for the IBM® PC and PC XT. From the company known for high

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Our MS™-DOS operating system tells your IBM PC how to think.

So don't monkey around with any other mouse. Call 800-426-9400 (in Washington State call 206-828-8088) for the name of your nearest Microsoft dealer. Then go with Microsoft Mouse. The mouse that soars.



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clocked at 10MHz. It supports a demand-paged virtual-memory environment similar to the DEC VAX.

The networking research project, funded by Digital Equipment Corp. ($40 million), IBM ($10 million), and MIT ($12 million), is expected, within five years, to tie together 6,000 personal computers, 63 DEC VAX minicomputers, and 150 DEC VAX microcomputers. All the systems will run various versions of UNIX. It is expected that most of the personal computer workstations will be Sun Microsystems and new DEC units similar to the Sun systems. MIT is expected to develop an enhanced version of UNIX (which was designed only to be a multi-user timesharing system) to operate in a shared resource network environment with enhanced graphics user interfaces utilizing windows and mice. It will probably be called the MIT version of Unix.

IBM CUTS PRICES IN WESTERN EUROPE

In March IBM slashed prices for the PC and XT throughout Western Europe. Price cuts ranged from 20 percent in West Germany to 25 percent in Spain for the PC, while XT prices were reduced 10 to 15 percent. The IBM systems, which have been on sale in Europe less than a year, have not met with the same success as they have in the U.S. and thus many experts feel that this price cut was made to stimulate sales. It is also significant that IBM is now assembling PCs and XTs in Scotland and is in a better position to price its systems competively.

KAYPRO PLANS TO MARKET PC-COMPATIBLE PORTABLE

Kaypro Corp., which together with IBM was instrumental in undermining Osborne Computer by introducing a similar but better and lower priced product, is hoping to repeat its success with an IBM PC compatible. They are promising that this summer they will introduce two IBM compatible systems. One is a notebook size, battery-operated machine from Japan. It is expected to be the first true portable with an 80 character by 16 line display. When plugged into its "base station," containing a CRT and disk drives, it is expected to run most IBM PC software. The price should be essentially the same as the new IBM transportable PC. The second new entry is a transportable machine.

Compaq Computer is also known to be working on a similar machine that is due out this fall. And there are rumors that Compaq is working with Lotus Development to develop special software for the machine.

IBM INTRODUCES TRANSPORTABLE PC

It was bound to happen and was predicted in this column eight months ago. The only question is why IBM waited so long to release its transportable. This was probably because of lack of production capacity and parts. Competitors, such as Compaq, Columbia, Corona, Eagle, and Seequa, are now being pressed to reduce prices and bring out models with extended features. Expect to see some of these companies introducing true portables with IBM-PC compatibility. Since the new IBM machine is not expected to be on dealers' shelves in significant numbers until late summer, competitors still have time to react.

At $2,795, the new machine, with 9" amber screen, 256K of RAM, and one disk drive, weighs in at 30 pounds. A second drive adds $425 to the cost. Thus, it is a little heavier and a little more expensive than its competitors. The competition will probably have to sell its comparable machines for at least 20 percent less than the IBM.

The transportable uses the same main circuit board as the XT, with eight bus slots instead of the five on the PC, and uses the same BIOS (Basic Input Output System) as the XT. The unit will be assembled at a plant in Austin, TX, from components and subassemblies purchased mostly from outside vendors.

It is expected that IBM will introduce a transportable with a hard disk late this year. Also in the works is a kneetop battery operated true portable that should be introduced next year, depending on what the competition does.

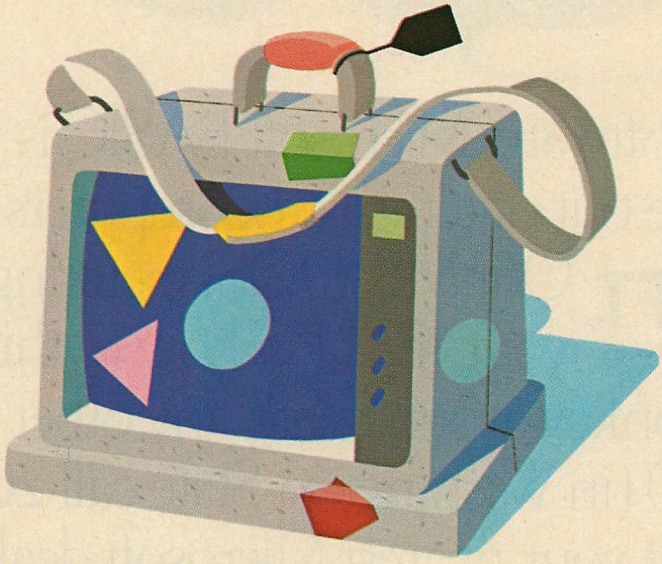


ILLUSTRATION • RICHARD OSAKA

IBM SUES EAGLE FOR COPYRIGHT INFRINGEMENT

Three weeks after filing suit against Corona Data Systems and Handwell Corp. for violating IBM's copyright on its BIOS (Basic Input Output System) software, IBM won another injunction against Eagle Computer Inc., San Jose CA. The BIOS code is in ROM and boots PC-DOS and handles all software interfacing between the hardware and applications software. Thus, in order for a system to be compatible with the PC its BIOS code must operate in the same manner as the IBM PC BIOS code.

The IBM PC contains four ROMs, three of which contain the code for the BASIC interpreter and the fourth the BIOS. All the other IBM compatible makers use a disk-based version of the Microsoft BASIC interpreter, called "GWBasic," which is compatible with IBM's version of Microsoft BASIC, but different enough not to infringe on IBM's copyright. However, the

THE TECH JOURNAL NEWSLINE

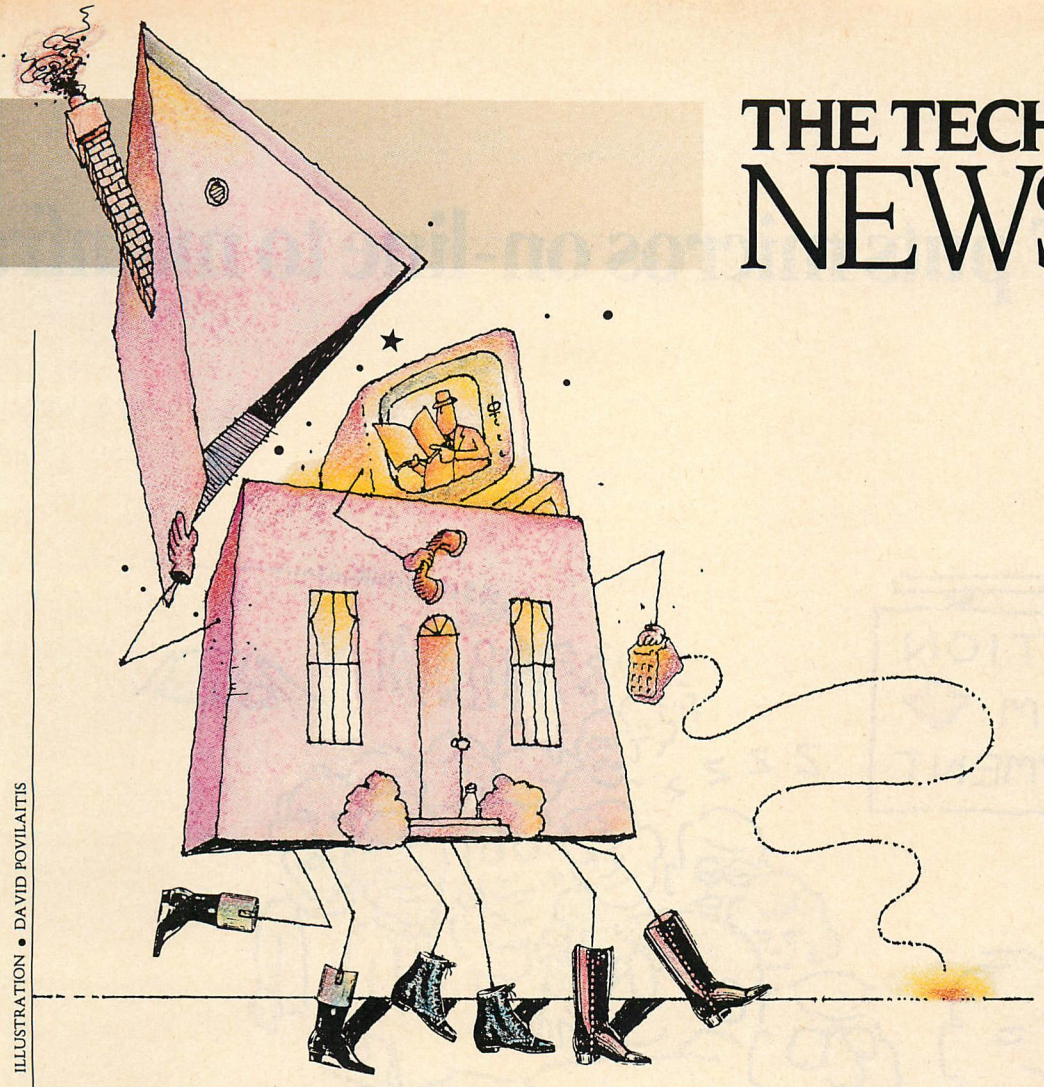


ILLUSTRATION • DAVID POVILAITIS

BIOS code is another matter. And, IBM has begun to get tough with manufacturers with whose BIOS code is very similar to its own code.

In all cases, so far, IBM has only asked for an injunction, to which the offenders have all quickly agreed. This has forced Eagle to write a new BIOS code, which it has.

IBM, CBS AND SEARS PLAN VIDEOTEXT VENTURE

IBM, CBS Inc., and Sears Roebuck & Co. have announced a joint venture into the home videotext business. Each company will hold an equal share in the partnership, and the venture will be staffed by employees from each governed by a committee of representatives from each company. Expected to take a few years to bring to fruition, it will bring two-way electronic services into the home and compete with a similar venture from AT&T. This new system would be different from the AT&T system in that users can use their own personal computers; the AT&T system requires users to purchase a $600 terminal.

Videotext will allow the sending of words and pictures to a home video screen. Thus it is expected that Sears will sell insurance, financial, and real estate services and also be responsible for marketing, billing and customer support, IBM will make the personal computers, and CBS will operate the videotext service.

IBM has been marketing a corporate videotext system based on its Series 1 minicomputer system and CBS had previously participated in a yearlong test of videotext with AT&T. There is one videotext system currently in operation in Southern Florida. The potential for videotext, however, is still uncertain.

IBM MOVES PC-COMPONENT PRODUCTION

Last month IBM told some of its PC disk drive suppliers that it would be buying fewer drives because it planned to start making its own disk drives. IBM has also disclosed that it will be making PC keyboards and printers at its Lexington, Kentucky plant, previously used only for typewriter production. IBM will spend $350 million to retrofit the 2.5 million square foot plant with robotized assembly lines.

IBM is currently buying dot-matrix printers from Epson, fully-formed character printers from NEC, and color dot-matrix printers from Dataproducts. The PC's keyboards are reportedly purchased from Minebea in Japan, while the PC*jr*'s keyboards are made by Advanced Input Devices, Coeur d'Alene, Idaho.

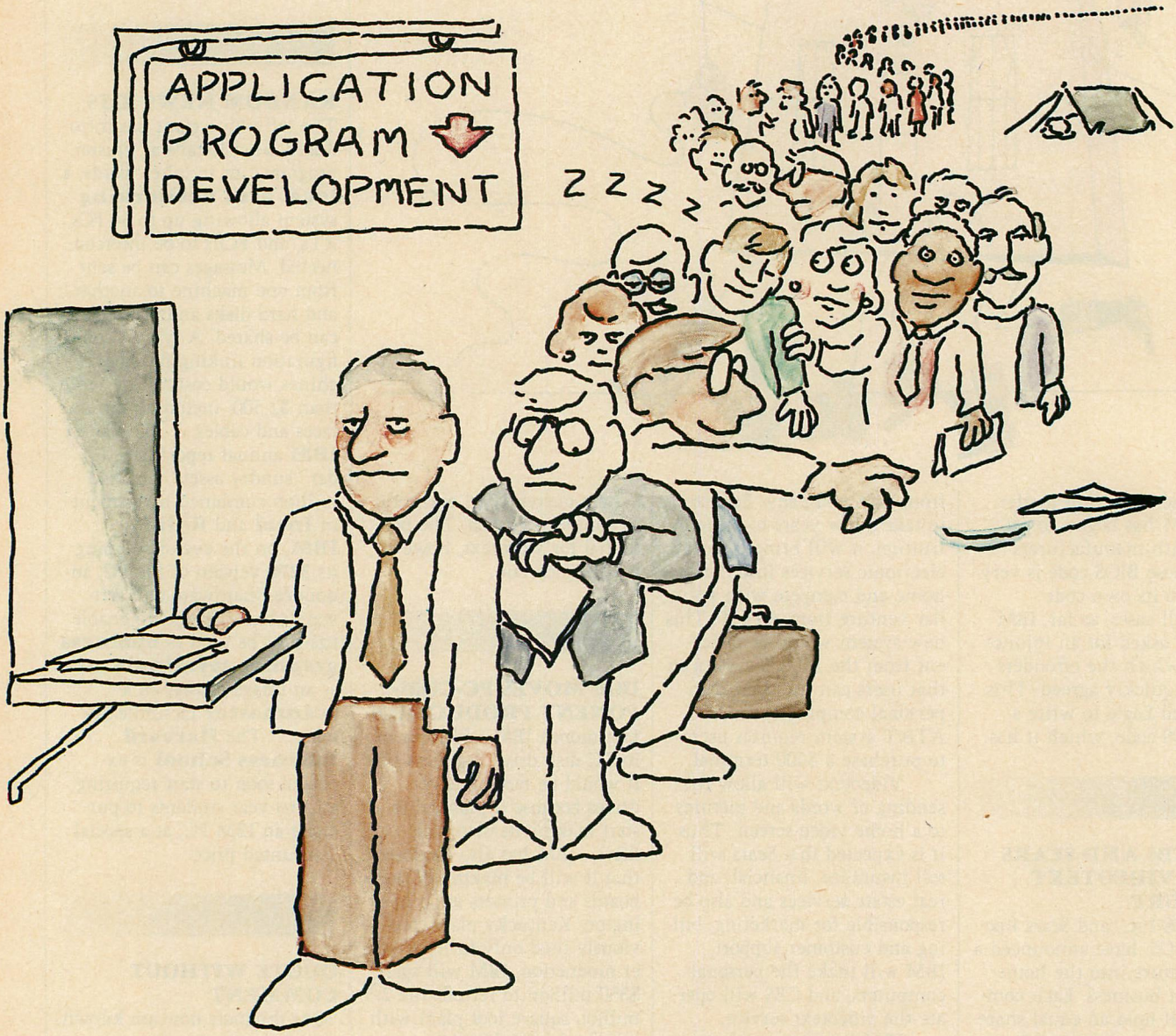
RANDOM NEWS BITS

The jolly blue giant has introduced what it calls a "cluster program," or in other words, a **local area networking** system allowing up to 64 PCs, XTs, and PC*jrs* to be interconnected. Messages can be sent from one machine to another and hard disks and printers can be shared. A typical configuration linking five machines would cost a little more than $2,500, including interfaces and cables. . . . The latest **IBM** annual report lists, under "sundry assets" an $843 million combined investment in **Intel** and **Rolm** . . . **IBM,** on the eve of shipping its **3270** version of the PC, announced hardware and software enhancements to enable the unit be used as **business graphics terminals** and as an image display in a **Scanmaster** facsimile system. . . . The **Harvard Business School** is expected soon to start requiring all first-year students to purchase an IBM PC, at a special discounted price.

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"Our products now are known
in every zone,
Our reputation sparkles like a
gem,
We've fought our way thru
And new fields we're sure to
conquer too,
For the ever onward IBM."
. . . IBM company song

m3278/SPF puts micros on-line to mainfra



Included in the m3278/SPF package is PCOX communications by CXI.

mes and cuts application software backlog.

A recent survey found that an average mainframe user would have to wait 3½ years for development work to begin on an application requested today.

That's a long time to wait.

In the same study, managers felt on-line programming offered the greatest potential for reducing the backlog.

It was their number one choice.

If on-line programming offers the greatest potential for cutting application program development backlog, what's the problem?

Simply this.

A limited number of programmers have mainframe access at any given time.

m3278/SPF™ can help.

Programmers on staff become more productive.

Productivity is substantially increased with m3278/SPF.

Why?

Because the programmers' workstation is not down while programs are compiling or downloading.

Coding continues without interruptions.

You may be able to eliminate application backlog without adding programmers. But, it is comforting to know programmers can be added without the expense of another host.

A substantial increase in the number of on-line programmers is possible with m3278/SPF.

The number of on-line programmers is doubled with m3278/SPF™ when only 40% of the programming effort is in Edit/Browse mode. But, when 90% of the effort is Edit/Browse, a whopping 7 to 1 increase of on-line programmers is realized.

With m3278/SPF,™ IBM PC users are directly on-line with the host computer via direct (coax) link at channel transfer rates.

Including, uploading and downloading programs or datasets. Attaining dataset listings as well as creating local new files or editing pre-existing ones.

Your IBM PC is a distributed SPF workstation allowing simultaneous local and remote SPF software.

Microcomputer uses are unparalleled when m3278/SPF operates under PC-DOS.

In addition, a multitask version of m3278/SPF is available for concurrent CP/M-86 users.

Users can perform several tasks at one time by swapping between functions and programs instantly.

For example, editing, compiling, and transferring can be performed simultaneously.

m3278/SPF emulates the 3278 terminal, yet surpasses its capabilities.

No time lost re-educating programmers.

With m3278/SPF™ experienced programmers can quickly and easily recognize the SPF emulation characteristics and operate more efficiently.

Overloading eliminated.

By performing editing functions locally, problems related to mainframe overloading are eliminated.

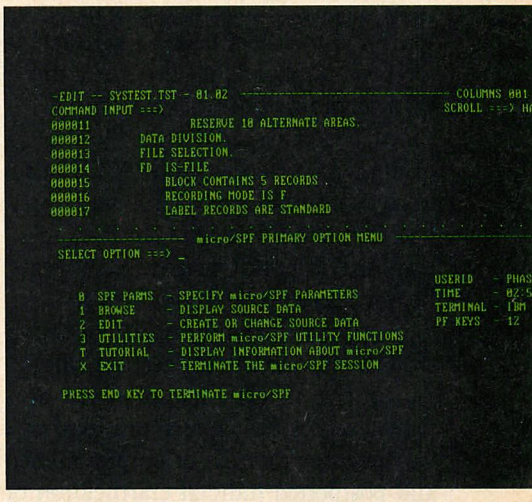
Mainframe datasets or source programs can be brought down to the microcomputer. Using the same mainframe software in an off-line fashion, datasets can be modified and returned to the mainframe.

No overload. No downtime. No trouble.

How you can cut mainframe application software development backlog.

m3278/SPF™ is announced for the IBM Personal Computer* and all IBM board compatible 16-bit microcomputers.

To find out how m3278/SPF™ can help turn the 3½-year wait into a tolerable number, contact us today.



PHASER

Mainframe Software for Micros

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Memories Are Made of This

Source code or object code, readable by humans or by computers, programs are copyrightable—so Apple has convinced two U.S. Courts of Appeals

MAX STUL OPPENHEIMER

Apple Computer and Franklin Computer had a rare opportunity to contribute to the state of the art in computer law. Apple had sued Franklin, alleging that Franklin had copied Apple's operating system and asking that Franklin be prohibited from using the system and ordered to pay damages. Franklin did not dispute that it copied the Apple programs but challenged whether the programs could be copyrighted. A Federal District Court (the trial-level court) had refused to prohibit Franklin's use of Apple's operating system because of doubts as to the copyright protection available to operating systems and to object code in general, as well as doubts about whether a program contained on a ROM chip should be considered "fixed" (a requirement for copyright). A Circuit Court (the first appellate level court) had instructed the trial court to reconsider. A petition for review was before the U. S. Supreme Court.

Apple and Franklin settled the dispute. In one selfish gesture, they ruined the article I had planned, deprived scores of lawyers and expert witnesses of months of employment, and postponed judicial clarification of the limits of protection for computer programs. Apple got $2.5 million and Franklin agreed to devise its own operating system.

The settlement leaves standing an opinion binding only in the Third Circuit (although courts in other circuits will certainly be influenced by its reasoning—the Ninth Circuit has already cited the Third Circuit opinion in reaching similar conclusions) that instructed the lower court to gather more data before deciding whether or not Franklin could legally copy Apple's operating system.

Max Stul Oppenheimer is a partner in the Baltimore law firm of Venable, Baetjer, and Howard.

THE DISPUTE

Apple sued Franklin in Philadelphia (it probably appealed to someone's sense of humor), claiming that Franklin, which had produced an Apple-compatible computer, had also produced an operating system that was too Apple-compatible—it had "stolen the logic and structure" of the Apple system. Apple produced testimony that the programs sold with the Franklin Ace 100 (four of which were stored in ROM chips and ten of which were supplied on a floppy disk) were identical to the Apple programs except for minor variations "consisting merely of such things as deletion of reference to Apple or its copyright notice."

Franklin's operating system also differed from Apple's in allowing the use of upper- and lower-case characters; a variation in 16 bytes of the 9,000 bytes in the two operating systems. Franklin's system did not differ in the portion of one program that contained the concealed word "Applesoft." Franklin admitted "copying each of the works in suit from the Apple programs." Apple asked the court to order Franklin to stop selling the copied system.

Apple had won a similar case in California (*Apple v. Formula International*, 562 F.Supp. 775, a decision affirmed by the Ninth Circuit Court of Appeals, after the Apple-Franklin settlement), and it appeared that Franklin's lawyers would have little to do at trial but look sheepish and try to gauge from which direction the lightning bolt would strike.

THE TRIAL

Franklin won.

The nature of the victory is somewhat difficult to categorize because of the procedural posture of the case at the time of appeal. Apple had asked for a "preliminary injunction," which would have prevented Franklin from using, copying, or selling the operating system until the court reached a decision on a "permanent injunction" to the same effect. Thus, under the law governing preliminary injunctions, the District Court was not asked to decide if Franklin had infringed Apple's copyrights, but rather if there was a "reasonable likelihood of success on the merits." Had the appeal process not intervened, the next step would have been an extended hearing, after which the court may have reached the same or a different conclusion.

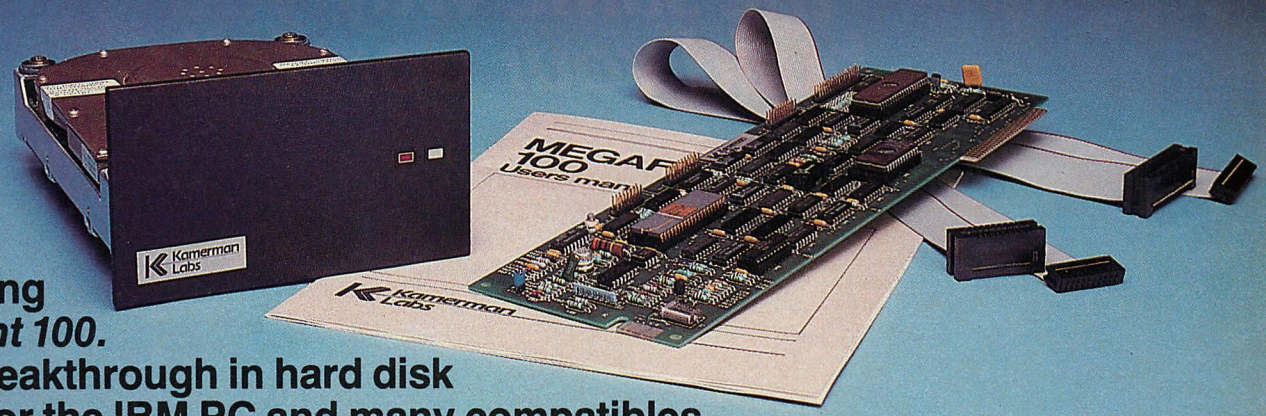
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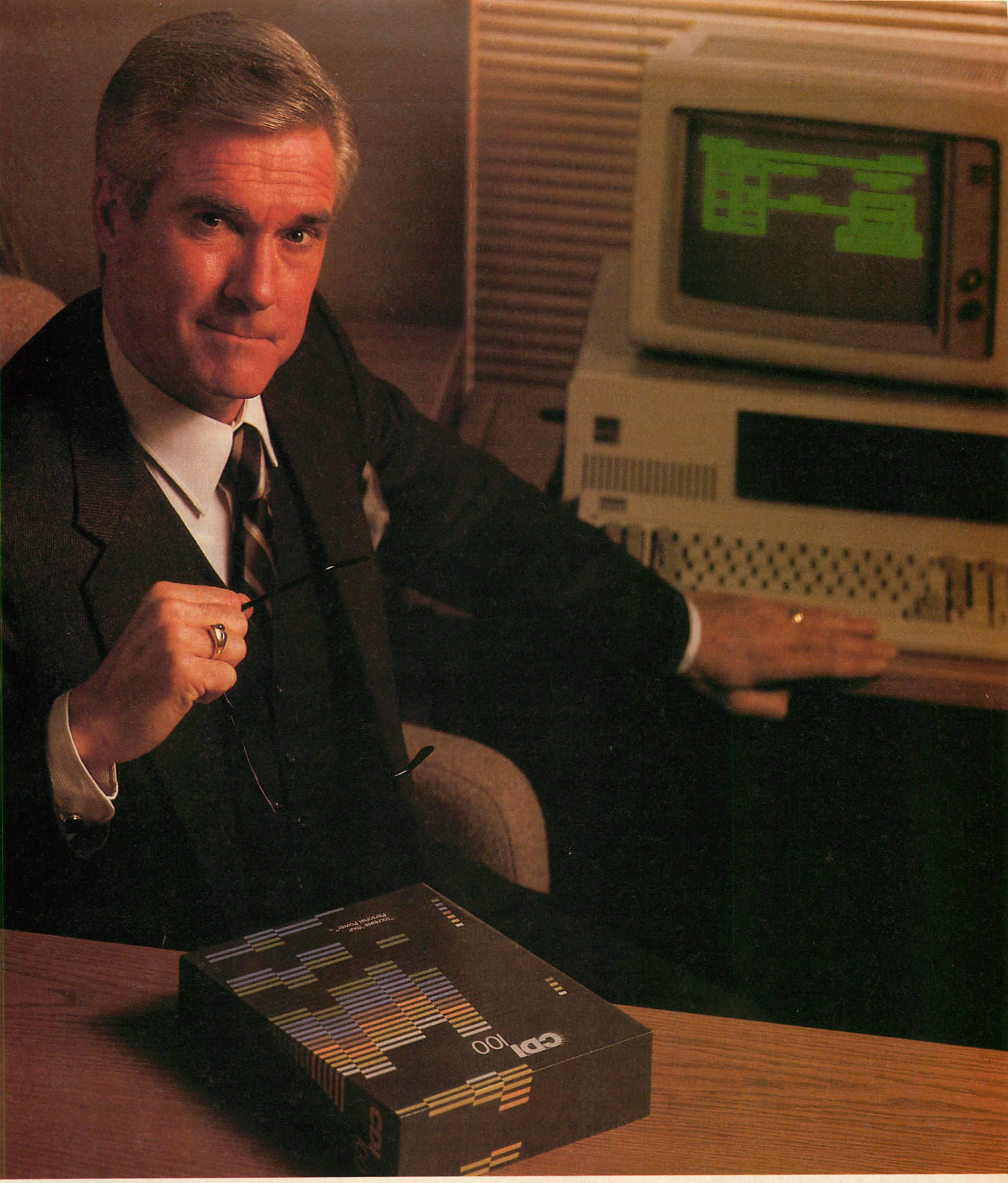
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suance of a preliminary injunction "would certainly have a devastating effect" on Franklin (a factor that the Circuit Court said should not have been considered) and that Apple had not shown "a reasonable *probability* of success," although Apple's arguments were "strong."

Federal copyright protection requires (among other things) that a work be "fixed" in a "tangible medium of expression" from which it can be communicated "directly or with the aid of a machine or device." Protection does not extend to ideas, procedures, processes, systems, or methods of operation.

The District Court's view of the probability of Apple's success was based on its uncertainty as to whether the law protected works of authorship embodied in ROMs, whether object code was a form of expression that could be protected by copyright, and whether an operating system was a literary work or merely a utilitarian aspect of a machine. The court distinguished between "operating" and "application" programs:

> An application program has a specific task, ordinarily chosen by the user, such as to maintain records, perform certain calculations, or display graphic images. Application programs are normally written in high level languages which are designed to be easily used by the unsophisticated. An operating program, by contrast, is generally internal to the computer and is designed only to facilitate the operating of the application program.

The court did not rule one way or another on any of these issues. It simply decided that, given the cumulative uncertainties that it perceived, if it would ever restrain Franklin from using the operating systems, it would not do so until the completion of a trial on Apple's petition for a permanent injunction.

The Issues on Appeal

Rather than allow Franklin to keep using the operating system while the potentially lengthy trial process continued, Apple appealed to the Third Circuit Court of Appeals.

The Third Circuit Court reversed because the District Court had "proceeded under an erroneous view of the applicable law." The District Court was, to some extent, the victim of very poor timing—three days after the District Court had decided the Apple-Franklin case, the Court of Appeals decided *Williams Electronics Inc. v. Artic International, Inc.* (685 F.2d 870), which held that, for copyright purposes, there was no distinction between source code and object code, nor did it matter that the program was embodied in ROM. Apple petitioned the District Court to reconsider based on the subsequent case but the court declined, perhaps because the *Williams* case left open the question of whether operating systems could be copyrighted.

The Circuit Court noted that the copyright statute protects expression that "can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device" (17 U.S.C. §102a). It also noted that the definition of a computer program covers "instructions to be used directly or indirectly in a computer in order to bring about a certain result" (17 U.S.C. §101). Thus, the words of the statute itself covered object code.

Citing its decision in the *Williams* case, the court held that a program embodied in ROM was copyrightable. In the *Williams* case, the court held that the issue was "not whether Plaintiff, if it sought, could protect the ROM itself," but rather "only the Plaintiff's effort to protect its artistic expression in original works which have met the statutory fixation requirement through their embodiment in the ROM."

This left the question of whether computer operating system programs could be protected by copyright. Franklin argued that an operating system is a method of operation and cannot be copyrighted.

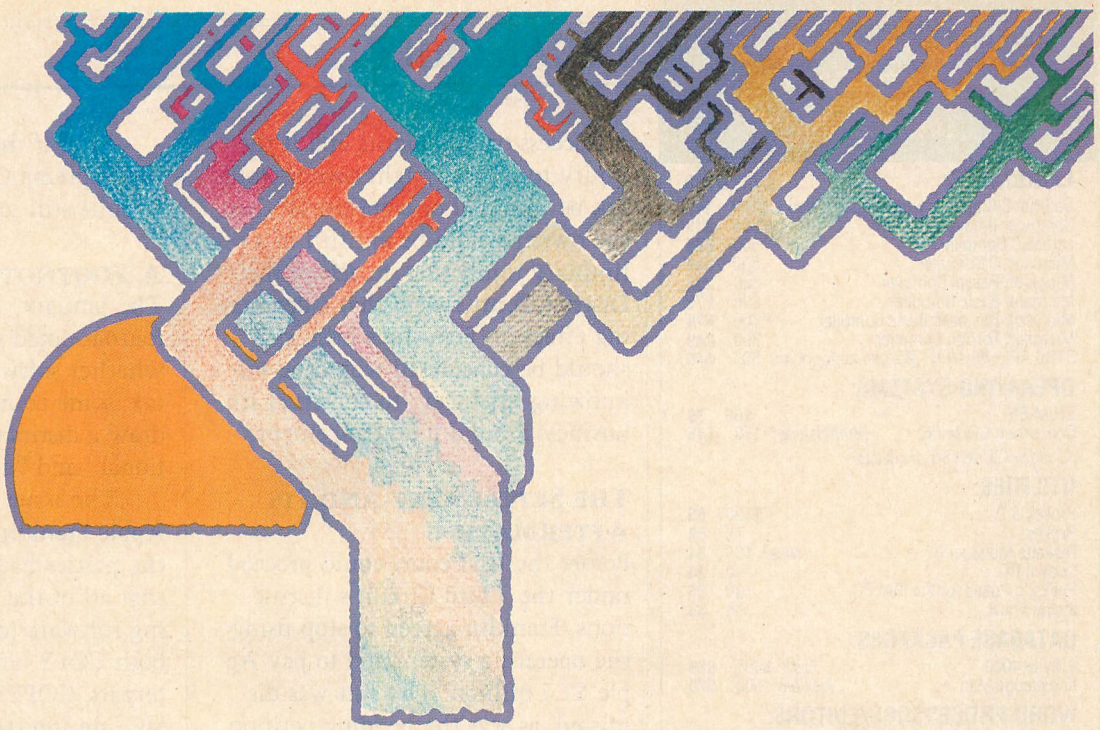
Section 102b of the Copyright Act provides that "in no case does copyright protection . . . extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is . . . embodied."

The report of the National Commission on New Technological Uses of Copyrighted Works (which is neither law nor entirely self-consistent but which is often cited by courts) suggests that if specific computer instructions are "the only and essential means" of accomplishing a given task, their use is not a violation of a copyright.

Franklin alleged that there were a "limited number" of ways to write an Apple-compatible operating system, although Apple introduced evidence that there were third-party Apple-compatible operating programs in existence, and Franklin admitted that it had tried to rewrite only one of the programs. On this issue the Court of Appeals found the record insufficient to make a judgment: "Although there seems to be a concession by Franklin that at least some of the programs could be rewritten, we do not believe that the record on that issue is so clear that it can be decided at the appellate level. Therefore, if the issue is pressed on remand, the necessary finding can be made at that time."

The court rejected Franklin's claim that even if the programs could be rewritten, the operating system constituted an idea rather than an expression of the idea and therefore could not be protected by copyright. It also rejected the argument that Franklin could copy Apple's operating system if such copying were necessary for total compatibility with third-party software.

Finally, the Court of Appeals concluded that the District Court had used the wrong standard in deciding whether or not to issue a preliminary injunction. In the Appeals Court's view, if a copyright owner demonstrated a reasonable likelihood



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LEGAL BRIEF

of success on the merits and if the injury to the copyright owner would not be minimal or conjectural, then the owner would be entitled to a preliminary injunction: to accept the District Court's view that a devastating effect on Franklin's business should be considered would permit a knowing infringer "to construct its business around its infringement."

The Settlement and Its Aftermath

Before the trial court could proceed under the Third Circuit's instructions, Franklin agreed to stop using the operating system and to pay Apple $2.5 million. The suit was dismissed, as was the pending petition to the Supreme Court.

The Third Circuit opinion stands as authority that computer programs are copyrightable, whether they are produced in source code or object code and whether they are produced in a medium intended to be read by humans or in ROM. It suggests that operating systems are subject to copyright and that infringement may be enjoined provided that there are other means of accomplishing what the operating system does.

Following the Third Circuit decision, IBM filed suits against Corona Data Systems and Eagle Computer, both of which were settled when the defendants agreed to rewrite the programs in question.

The Ninth Circuit opinion in Apple vs Formula International, also handed down after the Apple-Franklin decision, reached the same conclusions and further held that a preliminary injunction was appropriate because Formula International had not contended that there were no other ways to write an Apple-compatible operating system.

It is not, however, uncommon for Circuit Courts to disagree on the correct application of traditional legal principles to emerging areas of the law, particularly where the areas are as complex as those involved in the protection of computer programs.

Even if the issue never reaches the Supreme Court, there are eleven circuits still to be heard from.

A Footnote

The January, 1984 issue of *PC Tech Journal* noted that, in deciding whether software was subject to sales tax, some courts had attempted to draw a distinction between "operational" and "applicational" software.

The issue arose again in the Apple-Franklin opinions, although the parties had apparently agreed that all of the programs were operating software (despite the fact that both COPY, and its Applesoft counterpart, COPYA, are written in BASIC, are interactive, and obtain information from the user to determine how a disk copy is to be made—seemingly within the District Court's definition of an application program). The Circuit Court of Appeals noted the inconsistency of Franklin's conceding that application programs were subject to copyright but arguing that operating systems were not:

> Both types of programs instruct the computer to do something. Therefore, it should make no difference for purposes of section 102(b) whether these instructions tell the computer to help prepare an income tax return (the task of an application program) or to translate a high level language program from source code into its binary language object code form (the task of an operating system program).

Programmers may not see a distinction between operating system software and applications software—it may not really exist. However, it is a distinction that courts seem willing to consider. In any software-related transacton, some thought should be given to the possibility that a creative lawyer may someday argue that a judge should view the transaction in a particular way because it involves one or the other type of software.

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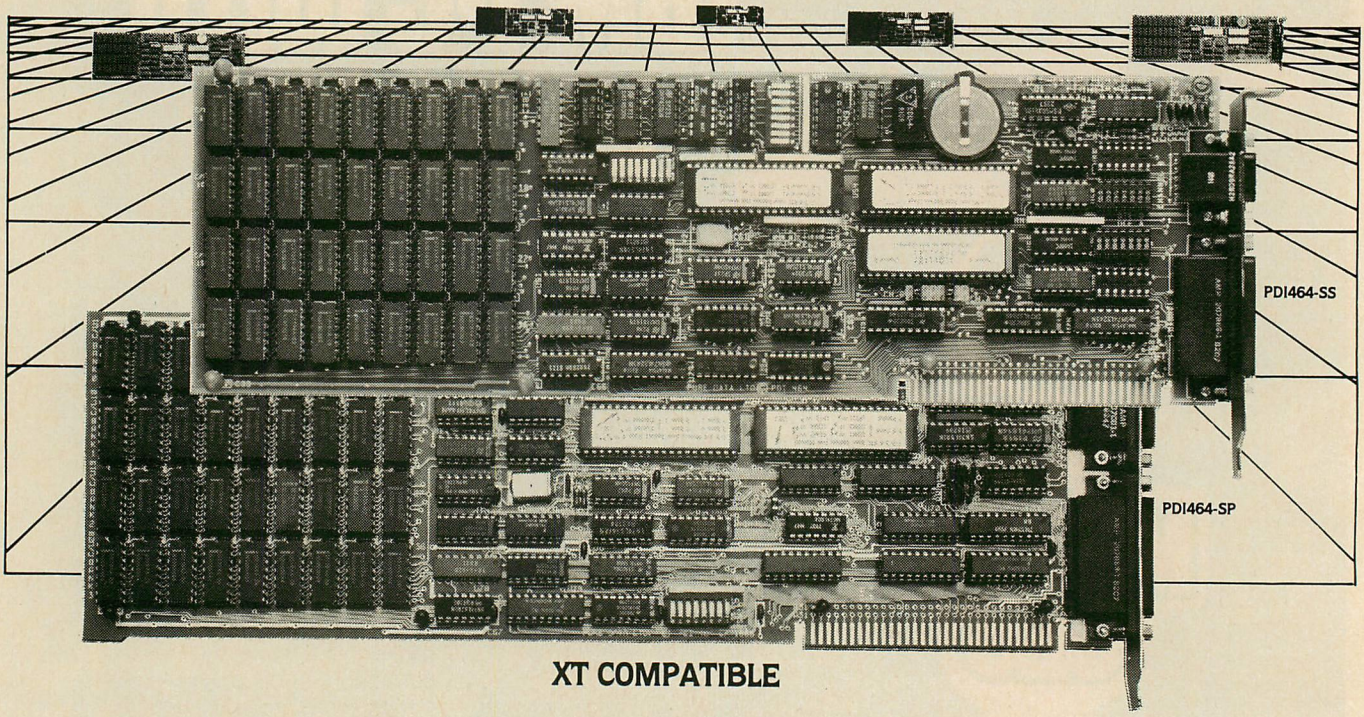
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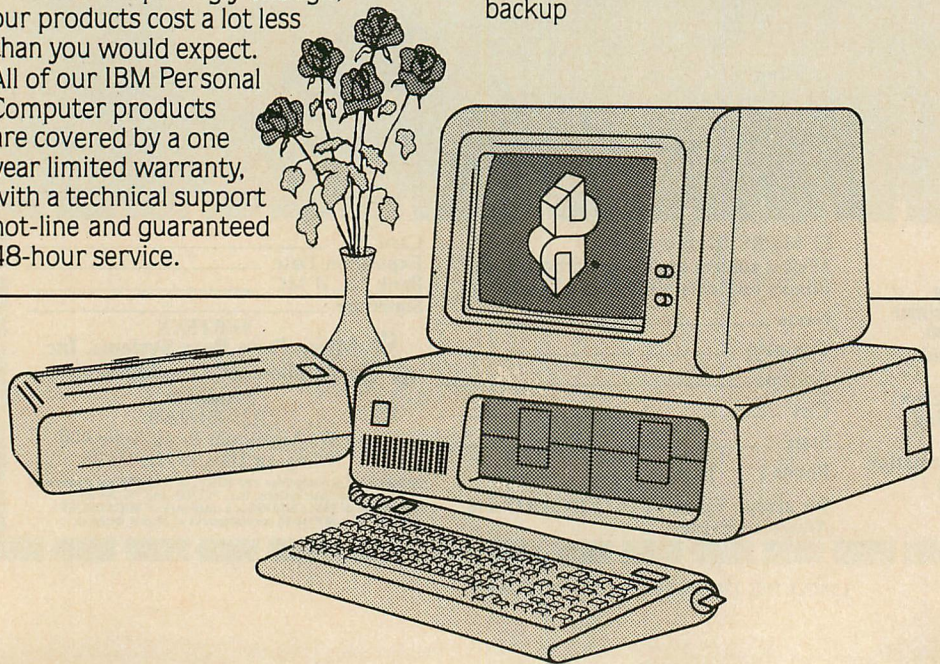
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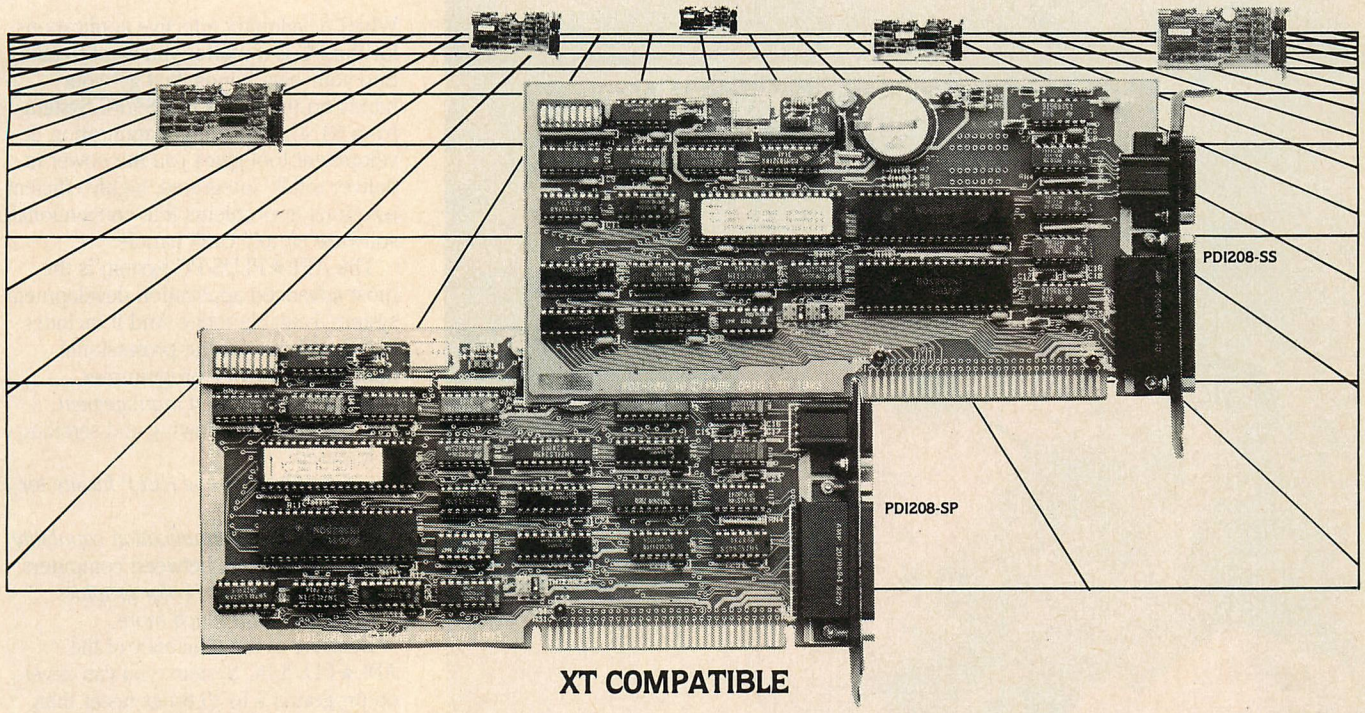
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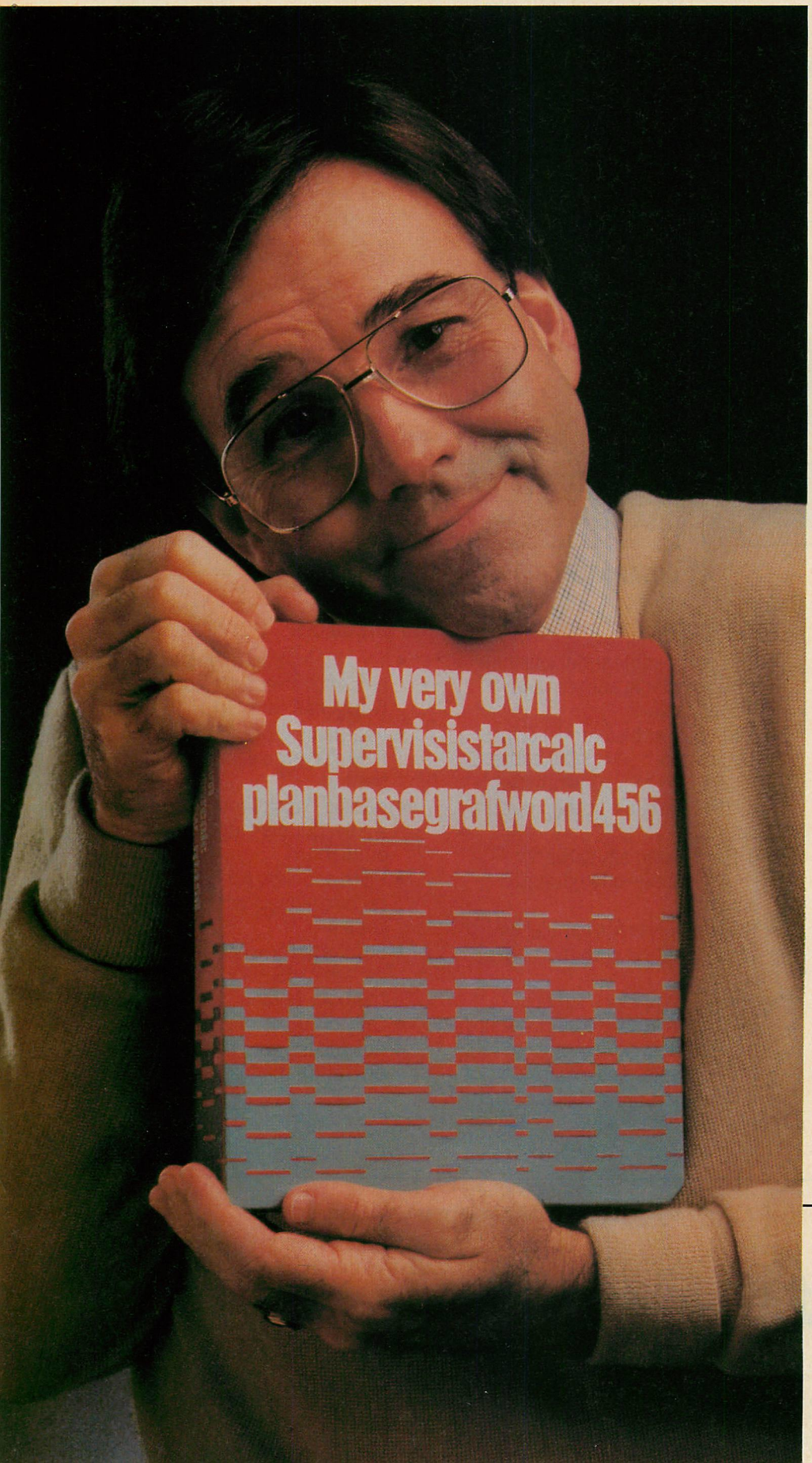
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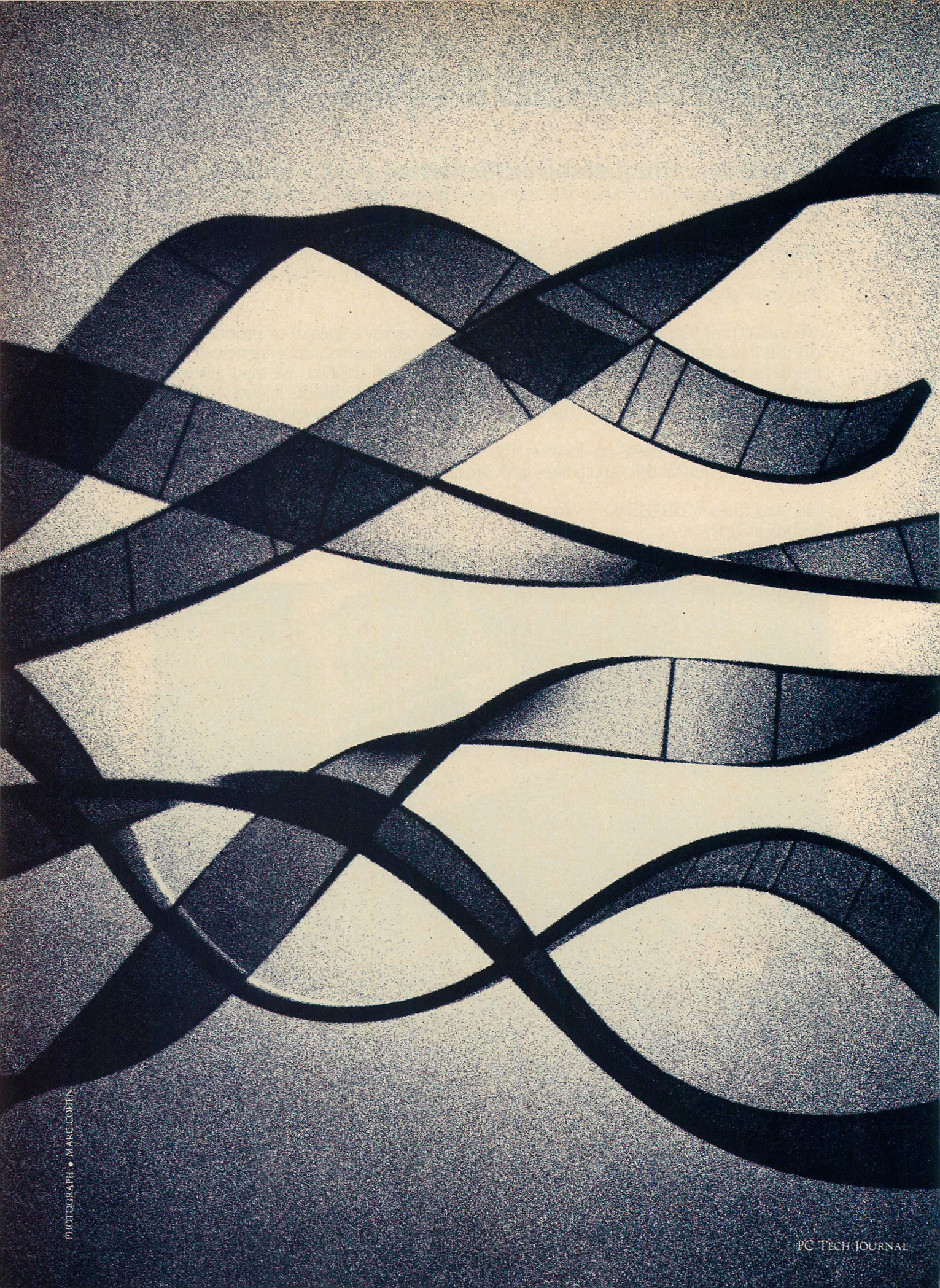
What makes the dBASE II star so bright—apart from the edge that being first brings—is the glow of its considerable aftermarket. Make a list of all those products and you'll quickly approach thirty items.

We made that list, and in the following pages we review a galaxy of products that dBASE II has spawned: program generators, screen generators, report generators, an interface between dBASE II and C, and about a dozen utilities. We also gathered technical tips for programmers who are trying to fine-tune dBASE II, and we take a close look at dBASE II file structures—useful information for recovering files.

We've divided our close-up look at the dBASE II Universe into three parts: file structures, technical tips, and a line-up of products in its aftermarket.

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PHOTOGRAPH • MARC COHEN

dBASE II FILE STRUCTURES

Accessing, indexing, and recovering data

CARL TOWNSEND

A data base management system, or DBMS, is essentially a group of programs designed to interface the user to a collection of information, which is called a *data base*. Program applications for DBMS include general ledgers, accounts receivable, inventory control, inquiry and mailing list systems, order entry systems, program and file directories, and bibliographies—just about any application in which data files are built, updated, analyzed, and reported.

A well-designed DBMS minimizes data redundancy and enables the data to be stored independently of the programs using the data. Data is manipulated and controlled from the DBMS, not from the application program (see figure 1). All application programs must access or modify data through the DBMS.

One of the most popular such systems is dBASE II, which is a relational data base management system. A brief review of the most common DBMS types will help clarify what is meant by *relational*.

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DBMS TYPES

There are only a few true data base management systems available on the market today. Most of the systems are either indexing systems or multi-file management systems (see figure 2). It is important to understand the concepts used in these simpler systems in order to understand how the true data base management system works. In fact, a professional programmer can develop more complex data base management systems using these simpler systems as components.

At the simplest (and least expensive) level are the indexing systems. These are used with existing high-level languages, such as BASIC or FORTRAN, or with assembly level programs to simplify the indexing process and to provide an access method to locate desired records in a file. ACCESS MANAGER, sold by Digital Research, is a good example of this type of product. Using ACCESS MANAGER, a programmer can create programs in BASIC, C, and PL/I that share common data files. Access to the desired records is simplified by using common routines that are integrated with the program at linkage time. Indexing systems require programming expertise and are fairly inexpensive.

There are only a few true data base management systems available today. Most of the systems are either indexing systems or multi-file management systems.

At the next level of complexity and cost are the multi-file managers. These often include an indexing system. They also include extra features that vary with the product—report generators or file-creation routines, for example. These products can often be used by people who have little or no programming experience. An example of a multi-file manager is FRIEND, The Report Generator, a popular program that can create a wide variety of report types.

The true data base managers used with microcomputer systems are generally one of three types: the hierarchical, the network, or the relational type. The hierarchical system views the information in a hierarchical, or treelike, relationship. A typical application would be an inventory system in which models are composed of assemblies, which are themselves composed of subassemblies and parts. The system appears much like an upside-down tree (see figure 3). A book is another type of hierarchical system: the book consists of chapters, the chapters consist of sections, and the sections are divided into paragraphs, sentences and words.

The network system is similar to the hierarchical except that the same part may be in several assemblies or subassemblies. As the hierarchical system is a special case of the network system, many programmers speak of only two types of data base systems—network and relational.

In the network system, the relationship between the items is stored in the data base with the items. Because of this, adding to the data base can be slow, as all relevant relationships must be updated when an item is added. Retrieval is fast, however, if the search is made on a relationship that is a part of the data base. The network type of data base is excellent for applications—such as an airline reservation system, for example—in which people calling into the system by phone must obtain fast information about data in the system.

There is a loss of flexibility, however. If a search must be made on a relationship that does not already exist, the entire data must be searched for matches. For example, an address file may provide fast access by name or zip, but if a user wants someone on Maple Street the search may take a long time. One of the most popular network systems for the microcomputer market is MDBS, by Micro Data Base Systems, Incorporated. Network systems require programming expertise and generally interface with a high-level language.

The relational data base, in contrast, stores all the information in two-dimensional tables. Each table is a separate file (see figure 4). Records are represented as rows and fields are represented as columns. Relational systems generally have their own support languages, which are usually high-level languages that are easy to use. Powerful tools are often included with the system for selecting, sorting, indexing, and reporting the data. As the relationship between the data is not stored with the data, powerful search strategies can be made and the systems are flexible. Relational systems do, however, have some drawbacks, including slow retrieval time and the lack of any relational information as a part of the stored data.

Relational systems generally have their own support languages, which are usually high-level languages that are easy to use.

The distinction between the two types is often misleading, as network systems can be used as relational systems by using an optional query program that can be purchased. In addition, relational systems can be used as network systems by storing the relationships in a separate file; this file can be used to drive network chains for analysis and reports.

In the end, the ease of use is often the deciding factor in determining which type of data base system to purchase. Because the relational system is easy to use and custom programs can be created at low cost, many users are using it to create their own custom programs. dBASE II is a good example of a relational data base system that can be used this way.

THE dBASE II DATA FILE

In a relational system, information is stored in a relation or table (see figure 4). Each row represents a collection of related information and is called a tuple. A table is a collection of tuples. Each column is a set of values for one particular data item or field and is called an attribute. The third column would be the third attribute of a relation. If there are five columns, the relation is said to be a tuple of degree five. A two-column relation is a binary relation, and a three-column relation is a ternary relation.

All information in a relational system is stored in a collection of one or more two-dimensional relations. Although this may come as a shock to the professional programmer who has worked with hierarchical and network systems for years, all hierarchical and network structures can be represented as a collection of two-dimensional, or "flat," files.

dBASE II, like most relational systems, has its own internal tools for defining the data structure. The user need only define the file name, the field names, the size of the field, and the type of data that will be stored in each field. The field definition is then stored in a header record for the file. After this definition, whenever the file is opened, the information about the fields and field sizes is automatically accessed and used. Unlike BASIC, dBASE II requires no FIELD statement when the file is opened, as the organization of the file has already been defined and stored in the data base.

In the data base each tuple must have a unique field or a unique combination of fields that can be used for identification. This field is defined as the primary key and can be used to build the primary index. In a customer file, for example, the unique field could be the account number. In an inventory file, the part number could be used. The programmer has the responsibility of insuring that whenever a record is added to the file, the primary index key is unique. The easiest way to do this is to insure that whenever a record is added a search is first made on the key of the record to be added. If no record can be found that matches the key, the record is added. Otherwise, the user is told that the record is already in the file and is given the opportunity to select another part number.

Additional, secondary, indexes are often created on other fields with nonunique keys. In a customer file, for example, a secondary index may be created in the last name.

Indexes can be either maintained automatically by the program as records are added and deleted or made "on-the-fly" when special reports are needed. With dBASE II, it is not advisable to use more than one index with a file that is updated frequently. Although a file can be opened with two or more indexes, the system will become slow when a record is added and more than one index must be updated. If secondary indexes must be used, they should be created when they are needed. A separate parameter file can be created that is used to store flags on whether a secondary index is up to date. When a report is first printed, the index is created, and subsequent reports will no longer create the index. Later, when a name is added, the flag is turned off to indicate that indexing is needed again.

An example of a dBASE II data file is shown in table 1. Notice that this is not a standard data file that could be used by CBASIC or Microsoft BASIC. A header record contains the date, number of records in the file, and the definition of the fields. The data begins at the second record.

The location of the bytes showing the number of records in the file is important, as we shall see later. On crashed data files with lost records, it may be possible to patch this number to the correct number of records and thus to recover the data. Optionally, it is possible to copy records singly to a second file until the end of the file is reached. This will be discussed more completely later.

Figure 1:
The Application Program and Data Base Management System

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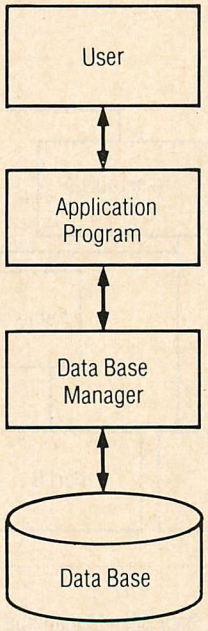
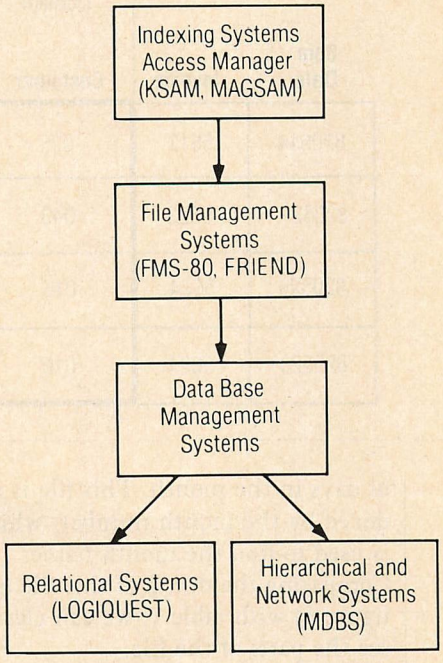


Figure 2:
Types of File Management Systems

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In table 2 is a simple dBASE II file structure. It contains a file of the months of the year, the corresponding month number, and the number

Figure 3:
The Hierarchical Data Base Management System

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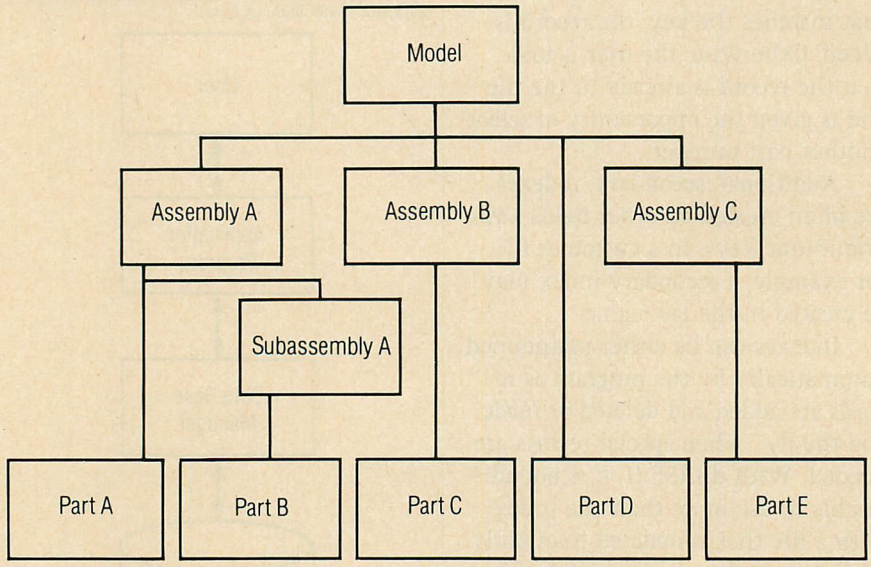


Figure 4:
The Relational Data Base Management System

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Ship Date	Invoice	Customer (Customer Domain)	PO	QTY	Model	Price
820514	5612	035	2367	2	A13	135.95
820521	5623	043	A235	3	A11	152.95
820529	5624	016	9845	1	B15	111.34
820529	5624	016	9845	2	B10	101.16

of days in the month. This file is indexed by the month number, which is used to find the month name. Comparing the dump of this file (see figure 5) with table 1, we can clearly see the parts of the file.

The first byte is an 02 and indicates that this is a dBASE II file. The next two bytes give the hexadecimal value of the number of records in the file (OC indicates 12 records). The date follows this in three bytes. The next two bytes give the length of each data record (14 bytes). This is followed by an array of 16-byte values, one for each field, for a maximum of 32 fields. For example, the first field defined in this array is

4E 4F 00 00 00 00 00 00 00 00 00 43 02 B9 AA 00

The first ten bytes are the field name in ASCII (NO), followed by a binary zero, the field type in ASCII (43), and then the field size in binary (02). The next two bytes are reserved. The final byte (00) is the number of decimal places if the field is numeric. This sixteen-byte sequence is repeated for each field defined. Up to 32 fields are permitted, so 512 bytes are reserved for field definition.

There are three fields in this example. dBASE II begins to store the data at 209. Notice that each record is 14 bytes long, having 13 bytes of data and one initial byte that is 20 if the record has not been deleted and 2C if it has been deleted.

It is a time-consuming and disk-intensive process to search an index file for a desired record. dBASE II solves this problem by constructing an "index to the index" within the index file.

ACCESSING THE DESIRED RECORD—ISAM

Two access methods are used in data base management systems: hashed and Indexed Sequential Access Method, or ISAM. dBASE II uses ISAM, a type of indexing system that offers the speed of random access with the convenience of locating any particular record easily. In its simplest form, ISAM stores the data records sequentially in the order they are entered into the system in the data file. A separate index file is built that contains the key information and a pointer to the record in the data file.

To locate a record, the index file is searched for the key and the pointer is read (see figure 6). Then the pointer is used to access the desired record in the data file. The data file can be quickly scanned in key order by using the index file, which is always maintained in key order. Multiple index files can be built and main-

tained for the primary key and any number of secondary keys. For example, a mailing list file may have a primary index on the name and a secondary index on the organization.

B-Tree Indexes

It is still a time-consuming and disk-intensive process to search an index file for a desired record. Even searching the index file sequentially can be time-consuming. dBASE II solves this problem by constructing an "index to the index" within the index file. A master index page is created that selects the desired subindex page. A page, as defined here, is a section or portion of the index that will conveniently fit in the computer memory.

The pointer in the master index, in this case, points to the location of the subindex page. The master index page and at least one of the subindex pages are in memory at all times.

With some systems there may be several levels of such indexes (indexes to indexes to indexes). The resulting configuration looks much like an inverted tree (see figure 7). This method of speeding up the index process is called B-tree indexing.

Several variants of B-tree indexing are used in ISAMs. Almost all systems try to keep the tree balanced dynamically at all times as items are added and deleted. That is, the number of entries in each "leaf" of the tree is kept about equal. The variation used in dBASE II is called B+ indexing. In this form, the master index page does not necessarily contain valid keys for the data file, but is used only to access lower levels.

The advantage of this method is that as the lower index levels are updated with additions and deletions, it is not necessary to update the higher index levels unless the tree becomes unbalanced, that is, unless the altered leaf becomes either less than half full or completely full. At this point the higher level of the index would need to be updated. For additional information on B-tree structures, refer to Douglas Comer's "The Ubiquitous B-Tree," in *Computer Surveys* (vol. 2, no. 2, June, 1979).

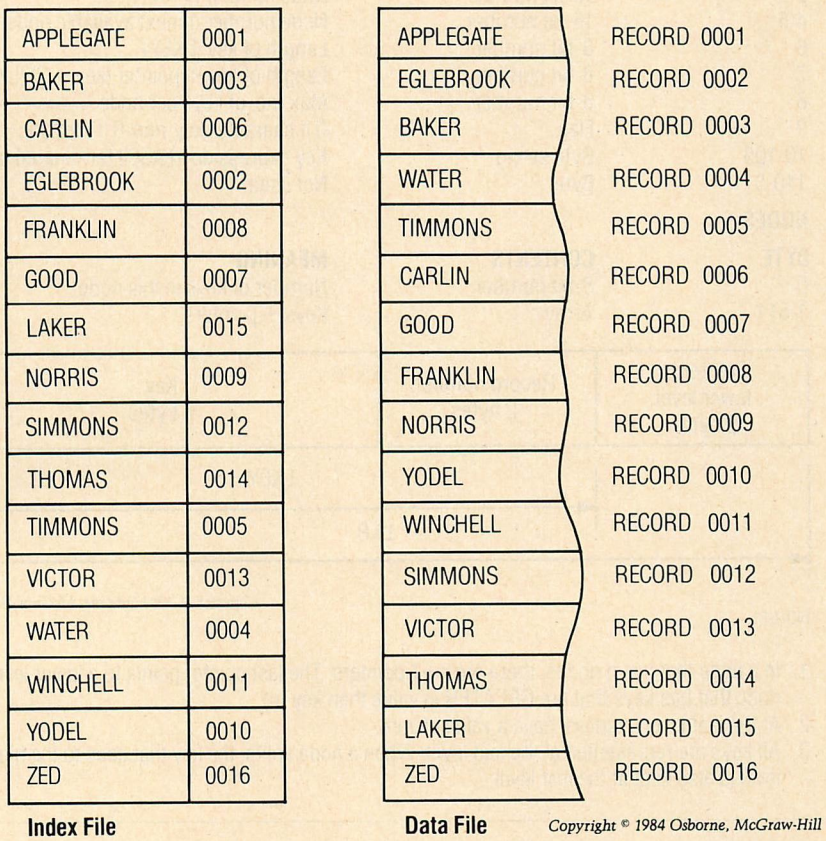
It is easy to see now why dBASE II slows dramatically if multiple indexes must be updated simultaneously. dBASE II is such a large program that there is little buffer space left for index and data files. Only a portion

Figure 5:
Dump Of Part of Example Data Base

```
0000:  02 0C 00 03 17 54 0E 00  4E 4F 00 00 00 00 00 00   .....T..NO......
0010:  00 00 00 43 02 B9 AA 00  4D 4F 4E 54 48 00 00 00   ...C....MONTH...
0020:  00 00 00 43 09 BB AA 00  44 41 59 00 00 00 00 00   ...C....DAY.....
0030:  00 00 00 43 02 C4 AA 00  0D 00 00 00 00 00 00 00   ...C............
0040:  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ................
.
.
.
0200:  00 00 00 00 00 00 00 00  00 20 30 31 4A 41 4E 55   ......... 01JANU
0210:  41 52 59 20 20 33 31 20  30 32 46 45 42 52 55 41   ARY  31 02FEBRUA
0220:  52 59 20 32 38 20 30 33  4D 41 52 43 48 20 20 20   RY 28 03MARCH
0230:  20 33 31 20 30 34 41 50  52 49 4C 20 20 20 20 33    31 04APRIL    3
0240:  30 20 30 35 4D 41 59 20  20 20 20 20 20 33 31 20   0 05MAY       31
0250:  30 36 4A 55 4E 45 20 20  20 20 20 33 30 20 30 37   06JUNE      30 07
0260:  4A 55 4C 59 20 20 20 20  20 33 31 20 30 38 41 55   JULY      31 08AU
0270:  47 55 53 54 20 20 20 33  31 20 30 39 53 45 50 54   GUST   31 09SEPT
0280:  45 4D 42 45 52 33 30 20  31 30 4F 43 54 4F 42 45   EMBER30 10OCTOBE
0290:  52 20 20 33 31 20 31 31  4E 4F 56 45 4D 42 45 52   R  31 11NOVEMBER
02A0:  20 33 30 20 31 32 44 45  43 45 4D 42 45 52 20 33    30 12DECEMBER 3
02B0:  31 1A 0C E8 31 0C A2 03  1E 58 C3 FE 06 3B 1F FE   1...1....X...;..
```

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Figure 6:
Using ISAM



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Figure 7:
The B-Tree Indexing System

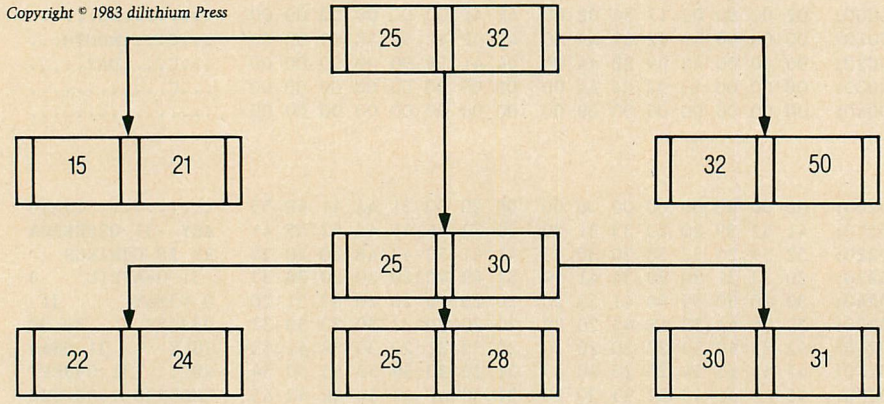
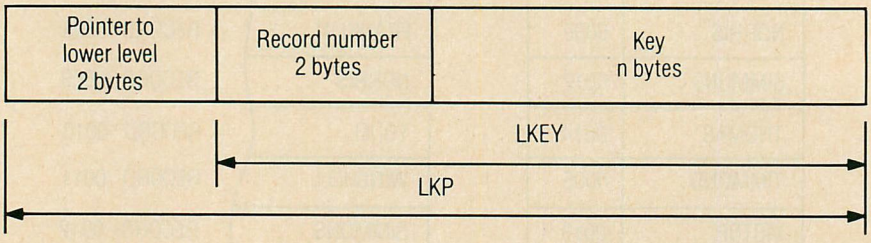


Figure 8:
The dBase II Index File Structure

BYTE	CONTENTS	MEANING
0-1	2 bytes	Reserved
2-3	16-bit number	Node number of root node
4-5	16-bit number	Node number of next available node
6	8-bit number	Length of key (LKEY)
7	8-bit number	Length of key + pointer (key + 2) (LKP)
8	8-bit number	Max. no. of keys per node
9	Flag	0 if character key, non-0 if numeric
10-109	Byte string	Key expression in ASCII terminated by 00H
110-511	Byte	Not used

NODES:

BYTE	CONTENTS	MEANING
0	8-bit number	Number of keys in this node
1-511	Array	Keys + pointers



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Notes:

1. In a node that has n nodes, there are n+1 pointers. The last pointer points to a lower level node that has keys that are GREATER in value than key (n).
2. At the leaf level, pointers have a value of zero.
3. All keys are represented at the leaf level. When a node splits, the key that goes to the higher level is also kept at the leaf level.

of each is kept in the computer memory. If the buffer is split for several indexes, there is little of the index in core, and the index levels must constantly be shuffled to and from the disk on updating. It is also easy to see why any data base management system is difficult to implement in a multi-user environment. Each person uses the system virtually—that is, a part of the data and index is in memory and part is on the disk. The paging is constantly changing as the file is updated and altered. If two or more users are changing the file, managing these changes becomes difficult.

THE dBASE II INDEX

The structure of the dBASE II index file is shown in figure 8. This is a B+ tree index, but the organization of the pointers varies slightly from the earlier B-tree diagram. Remember, the "plus" indicates that higher levels are not reorganized on updating unless the tree becomes sufficiently unbalanced.

Figure 9 shows a dump of the index file that is used with the data file shown in table 2. The first two bytes are reserved; following this are two bytes for the node number of the root node (01) and then the next available node (02). The next two bytes indicate the length of the file space needed for the key and the pointer to the record number. In figure 8 this value is LKEY; in figure 9 it is 04.

Serious dBASE II users, however, will inevitably encounter the situation in which they find their inventory of two thousand records has disappeared and the last update was more than a week ago. Fast data recovery will be required then.

The second byte (06) is the value of LKP, which is LKEY plus the length of the pointer to the next lower node. Since there is only one level in this example, the next lower node is 00. This indicates everything is stored at the leaf level. After the LKP value, the maximum number of keys per node is indicated. Finally, a byte is used to indicate whether the key value is numeric or character. Starting at 200 are the index entries or LKP values. Each is six bytes in this

example, with the key value being the last two bytes. The first LKEY value is

00 00 01 00 30 31

In this example, the pointer to the lower level is 00 00, the record number in the data file is 01 00, and 30 31 is the ASCII value for 01.

Users should take the time to explore some of their own index and data files using this information—particularly the data files. This will help them if a dBASE II file crashes and needs to be recovered.

Recovering Damaged Files

Programmers most frequently need to understand and use information on the structure of a dBASE II file in connection with the recovery of a damaged file. This problem is most likely to occur on a power fluctuation or in attempting to use a damaged disk. If backups are made frequently, the problem will never be major. Serious dBASE II users, however, will inevitably encounter the situation in which they bring up the system and find their inventory of two thousand records has disappeared and the last update was more than a week ago. Fast data recovery will be required at that point.

Remember that dBASE II is a large data base management system and program for microcomputers. All of dBASE II does not reside in the computer memory at one time, and various parts of the program come and go from the disk as they are needed. In getting as many features as possible into dBASE II with the small memory limitation imposed (48K), the developers sometimes compromised on the error-recovery routines. The programmer should assume the major responsibility of detecting error conditions. For instance, always close files that are not in use, declare variables by storing dummy variables to them, and avoid untried techniques in programs.

The new dBASE II 2.6 for sixteen-bit computers should be released shortly. It is anticipated that this version will use the extra memory of 16-bit computers to improve error recovery. The latest releases of dBASE II are considerably better at trapping and recovering from errors than earlier versions.

In a dBASE II data file, as we have seen, the number of records in the data base file is stored at the beginning of the file in the header record. The header is updated each time the file is closed. If the system crashes or an unusual error occurs

Figure 9:
Partial Dump of Example Index File

```
0000:  00 00 01 00 02 00 04 06   54 00 4E 4F 00 FC BE A1   ........T.NO....
0010:  23 8B 44 FE 89 46 FC FF   46 FC 0A DB 74 02 03 F0   #.D..F..F...t...
0020:  89 76 FE FF 4E FC 75 0F   A1 53 1F A3 51 1F BE A1   .v..N.u..S..Q...
0030:  23 E8 EA 09 E9 31 01 80   3E 3F 1F 00 75 08 8B 76   #....1..>?..u..v
0040:  FE FF 46 FE EB 06 FF 4E   FE 8B 76 FE 8A 04 BE 72   ..F....N..v....r
0050:  21 E8 E1 6F 72 02 FF E6   E8 AF F9 FF 06 2F 1F E8   !..or......../..
0060:  0F 01 EB BF B0 01 EB 02   32 C0 E8 D6 03 80 3E 3F   ........2.....>?
.
.
.
0200:  0C 00 00 01 00 30 31 00   00 02 00 30 32 00 00 03   .....01....02...
0210:  00 30 33 00 00 04 00 30   34 00 00 05 00 30 35 00   .03....04....05.
0220:  00 06 00 30 36 00 00 07   00 30 37 00 00 08 00 30   ...06....07....0
0230:  38 00 00 09 00 30 39 00   00 0A 00 31 30 00 00 0B   8....09....10...
0240:  00 31 31 00 00 0C 00 31   32 00 00 1F 00 00 E9 F6   .11....12.......
```

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Table 1:
dBase Data File Structure

BYTE	CONTENTS	MEANING
0	02H	dBASE II data base file identifier
1-2	16-bit number	Number of records in this data base
3-5	3 bytes	Date of last update (MM/DD/YY) (binary)
6-7	16-bit number	Length of records (binary)
8-520	16-byte array	Field descriptors (32 total)
	byte 0-9	Field name in ASCII (zero-filled)
	byte 10	Zero (binary)
	byte 11	Field type, "C," "N," or "L" ASCII)
	byte 12	Field size (binary)
	byte 13-14	Reserved
	byte 15	Number of decimal places (binary)

Notes:

1. Data records are preceded by one byte that is a space (20 hexadecimal) if the record is not deleted and an asterisk (2C hexadecimal) if it is deleted.
2. Data fields are packed into records with no separators or record terminators.
3. The last field descriptor is followed by a carriage return character (0D hexadecimal).

Table 2:
The Example Data Base

Structure For File:	B:Month	.DBF
Number Of Records:	00012	
Date Of Last Update:	00/00/00	
Primary Use Data Base		

FLD	Name	Type	Width	DEC
001	No	C	2	
002	Month	C	009	
003	Day	C	002	
	Total		00014	

pulled from the drive before the file was closed), the header record is not updated, and the file will not work properly in any dBASE II program.

Indexes are fairly easy to recover. In any collection of dBASE II programs, the designer should always add programs to rebuild any or all indexes for the user. As all of the information needed to create the index is in the data file, dBASE II can always rebuild the index with an INDEX command. The fields used to build the index are located in the first record of the index file, so it is possible to dump this record and see how the index was created. A user can also use the REINDEX command to rebuild the index without the need for a TO expression, but this assumes the first record in the current index file is correct. A safer precaution is to use the TO expression in the reindexing program. If any problems develop in the use of a program that has worked correctly in the past, try reindexing as a first step to recovery.

Rebuilding data files, however, is another problem. Fortunately, if files are closed properly after use, there will seldom be a problem with bad data files. Even with hardware crashes, data files will generally lose only the last few records.

If a data file does go bad, first try to COPY it to another file or append it to a temporary file with the same structure. If this fails and only a few records or none are copied, it may be possible to use the GOTO command to access any record in the file, but if the user tries to list the file, he will not see all the records. If this is true, a program similar to the one in listing 1 can copy the file correctly using the GOTO command.

In listing 1, MAX is the number of records that should be in the file. In some cases, the data file can also be recovered by patching the correct number of records into the proper location in the header record. Of course, always have a copy of the file before trying either approach.

dBASE II, like all data base management systems, has its drawbacks, but if the user knows how to avoid problems when possible and how to handle them when they do occur, the process of dealing with data will be greatly eased.

Editor's note: Portions of this article are reprinted from two books by the same author: Using dBASE II *(OSBORNE/McGraw-Hill, Berkeley, CA, 1984) and* CP/M Database Management Systems *(dilithium Press, Beaverton, OR, 1983).*

Listing 1 A Program to Copy Files Using the GOTO Command

```
SELECT PRIMARY
USE summary
SELECT SECONDARY
USE temp
SELECT PRIMARY
STORE 1 TO ctr
STORE 60 TO max
DO WHILE ctr<=max
     GOTO ctr
     SELECT SECONDARY
     APPEND BLANK
     REPLACE s.type WITH p.type, s.name WITH p.name
     REPLACE s.total WITH p.total, s.income WITH p.income
     REPLACE s.thrs WITH p.thrs
     SELECT PRIMARY
     STORE ctr+1 TO ctr
ENDDO
```

Query Operations Using Relational Algebra

Every data base management system must include a method for retrieving information from the data base. This is usually a high-level, nonprocedural query language that interfaces the user directly to the DBMS and handles ad hoc requests for data.

Several types of query languages have been implemented for relational data bases. Languages based on relational calculus first define a range over which the selection is to occur, and then state a condition that the target data must meet. With a query-by-example language, users make requests by filling in a blank form with sample data that is representative of the items to be retrieved.

A third type of query language is relational algebra, which is based on a set of operations that are performed on relations. The output of each operation is a new relation. I will focus on the ability of dBASE II, which closely implements relational algebra, to perform the following operations: permutation, select, join, and project.

Table 1 provides a sample employee data base implemented in dBASE II. Two relations are defined in this example: Employee and Department. Employee has 10 tuples with the attributes EMP:NO, EMP:NAME, DEPT:ID, and CUR:SALARY. The Department relation has three tuples with the attributes DEPT:ID, DEPT:NAME, and MANAGER:ID. In dBASE II each relation corresponds to a physical data base file.

PERMUTATION

In a relation, the order of rows, or tuples, is not significant; the order of columns, or attributes, is. The permutation operation yields a relation with the same attributes as the original relation has, but these attributes have been rearranged. If a relation has *n* attributes, there are *n!* (*n* factorial) possible permutations including the identity relation. Permutation's usefulness extends beyond rearranging fields in a data base. Judging from its inclusion in the set of operations, the derivation of a relation's permutation is sufficient to prove that the relation itself can be produced.

In dBASE II, permutation is performed by using the COPY command; the FIELD parameter specifies the order of attributes in the new relation. The following command will create a permutation of the sample Department relation:

COPY TO temp FIELD

```
dept:name,
dept:id,manager:id
```

SELECT

The select operation, also called restriction, yields a subset of the original relation based on a condition expressed as a combination of Boolean terms. Each tuple in the input relation that the condition evaluates as true is included in the output relation.

Any of the following dBASE II commands could find all employees with salaries greater than $35,000:

```
COPY TO temp FIELD
  emp:name,cur:salary FOR
  cur:salary > 35000
```

or

```
DISPLAY ALL FOR cur:salary
  > 35000 FIELDS emp:name,
  cur:salary
```

or

```
LIST FOR cur:salary > 35000
  FIELDS
  emp:name,cur:salary
```

DISPLAY and LIST create a logical relation that is displayed on the screen. Only COPY creates a physical file on which further operations can be performed. Note also that the resulting relation has only two attributes. Not all the attributes in the original relation need to be included in the output relation.

JOIN

The join operation combines two relations according to a specified condition; more specifically, it performs a select on the Cartesian Product of the tuples of the two relations. An unrestricted join would form an output relation whose tuples contain all the attributes from both input relations and represent all combinations of tuples.

The dBASE II JOIN command conforms precisely to the relational algebra definition. For example, to find each department manager's name, the following commands could be used:

```
SELECT PRIMARY
USE dept
SELECT SECONDARY
USE empl
JOIN TO temp FOR
  manager:id=emp:no FIELD
  emp:no,emp:name,
  dept:nam e
```

The generated relation is illustrated in table 2.

PROJECT

Project creates a relation by selecting columns from the input relation and deleting duplicate tuples. A project on a single attribute thus reflects the unique values for that attribute.

The dBASE II TOTAL command was designed to calculate subtotals, but it can also perform a project—with two restrictions. First, the input relation must be sorted on a primary key; this key, which is restricted by the TOTAL command to one field, determines the uniqueness of the tuple. The TOTAL command restricts this selection key to one field. Secondly, the output relation must have at least one character field, because the TOTAL subtotals numeric fields unless the FIELD parameter is used and includes character fields only.

If the output file already exists, then its structure will determine which attributes are copied; otherwise, TOTAL creates an output relation that has the same attributes as the input relation. If the output file does not exist and a subset of the original attributes is required, COPY should precede the TOTAL.

The following commands find all unique department id's in the employee data base:

```
COPY TO temp FIELD dept:id
USE temp
INDEX ON dept:id TO TEMP
TOTAL ON dept:id TO temp1
  FIELD dept:id
```

The FIELD parameter is redundant here but would be needed to avoid subtotaling if the output relation had any numeric fields.

LIMITATIONS AND CONSTRAINTS

The dBASE II limitation of two open data base files is not a problem using relational algebra because the operations accept either one or two relations as input. Queries are executed as a series of operations; the output relation of one operation becomes the input relation of the next.

In dBASE II the relations created by the relational algebra operations must be physical files to be processed further. Periodic garbage collection must thus be done; temporary files must be manually deleted.

The output relations can be used only for queries, not for modifying the data. If the data in the output relation are modified, the original data will remain unchanged. dBASE II does not maintain a logical connection between the data in the output relation and the original data. —*Julie Anderson*

Table 1: Employee and Department Relations

EMP:NO	EMP:NAME	DEPT:ID	CUR:SALARY
1023	Abernathy	MANU	34500
5624	Butterworth	SALE	10500
5984	Carter	MANU	50000
2537	Devine	ACCT	22500
2984	Evans	SALE	45675
7493	Fisher	ACCT	35000
3847	Goldstein	ACCT	41000
8365	Holden	SALE	10500
7485	Ingerness	MANU	18500
3476	Johnson	ACCT	51350

Employee Relation

DEPT:ID	DEPT:NAME	MANAGER:ID
ACCT	Accounting	3476
MANU	Manufacturing	5984
SALE	Sales	2984

Department Relation

Table 2: Output of Join

EMP:NO	EMP:NAME	DEPT:NAME
3476	Johnson	Accounting
5984	Carter	Manufacturing
2984	Evans	Sales


AUTUMN
November
December
Winter Solstice 21 Dec.
Perihelion
31 December
January
Februar
WI
EARTH
SUN

Some Technical Aspects of dBASE II

Getting the most from this valuable tool

Ashton-Tate, the firm that markets dBASE II, through a campaign of clever advertising, marketing, education, and programming, has succeeded in setting up dBASE II as the standard by which all other micro-based data base management systems are judged—at least for a while. It is prudent for anyone in the field of data bases to develop an understanding of the capabilities and limitations of dBASE II as a reference point from which to view other packages that perform similar functions.

It is not my intent to write a product review of dBASE II here, but rather to emphasize some of its more salient features, offer some suggestions for its use, and explain some of its technicalities.

The Command Language

At the present time, 64 commands are available to the dBASE II programmer. There are two modes in which most of these commands may be used—keyboard entry and program execution. Some commands are reserved for program use only (for example, DO WHILE, IF) because they direct program flow and control.

The typical structure of a dBASE II command line for data retrieval goes something like this:

VERB [(scope) (field list) FOR (expressions)]

The bracketed area is often optional. Of course, the combinations available are astronomical considering the number of commands and functions offered. Here's just one example of available permutations:

```
DISPLAY NEXT 10 part:numb,
(price + price * .065), qty FOR
cost <= 100 .AND. (customer
= "Golden Haven Auto"
.OR. customer = "Wigwam
Movers Inc.") TO PRINT OFF
```

This command would look at the next ten records in the currently open data base and would list on the screen and printer any data in the fields called PART:NUMB and QTY as well as the PRICE + tax, only if the COST was less than or equal to $100 and the customer is one of the two listed. The OFF phrase suppresses record numbers from the listing. Admittedly, this is not a typical command line, but it illustrates what can be done with dBASE II.

Most of the commands and functions perform the usual housekeeping or data-retrieval duties expected from any DBMS, such as adding, editing, and deleting records, replacing data in fields, and even changing the "structure" of a data base after information is stored in it. However, in addition to these ordinary functions, dBASE II has a few commands and features that deserve special note.

The first of these unusual features has to do with the use of Format files. dBASE II will permit

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ROBERT COWART

ILLUSTRATIONS JOHN PACK

the user to create/use seven types of files with the following default file name extensions:

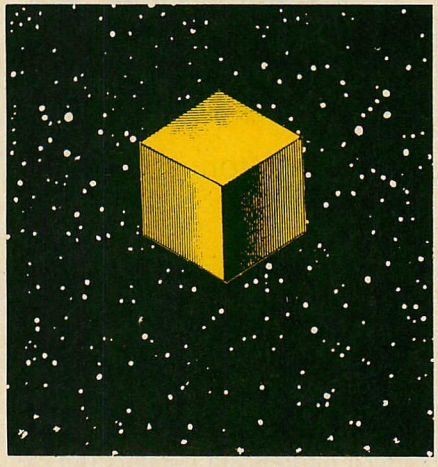
Type	Extension
Command	.PRG
Data Base	.DBF
Index	.NDX
Format	.FMT
Report	.FRM
Text	.TXT
Memory	.MEM

Notice the FMT extension. This suffix is used with files that contain information regarding screen formatting for entry, editing, or display of data. By simply creating a new .FMT file—with a text editor, dBASE II's editor, or a screen generator such as SED (formerly ZIP)—and issuing a SET FORMAT TO. . . command, the user can create his own screens in a matter of minutes.

UPDATE, JOIN, SORT, and INDEX are four powerful file manipulation commands. UPDATE will perform a batch update of one file from another. If a user has one transaction file that he uses at the cash register and another for tracking inventory, at the end of the business day, the inventory file can be UPDATEd from the transaction file, assuming the files have a common key field. The file from which the UPDATE information is drawn does not have to be sorted on the key, though the UPDATE will be expedited if it is. The UPDATE may either ADD (mathematically) to the data in the UPDATEd file's field(s) or REPLACE it.

JOIN will create a new data base from two existing ones when specific criteria are met. It works like this: open two data bases using the primary and secondary areas. dBASE II goes to the top of each file and compares record 1 of the main file against each record in the secondary file. Each time the criteria for JOINing are met, a record is added to the "new" data base, pulling in data from only the fields (of either file) that are listed as part of the command. dBASE II then advances to record 2 of the main data base and repeats the process.

This task probably takes more time than any other in dBASE II. The only way to work around this is to use as fast a processor as possible and a hard disk with lots of space. Also, be careful not to specify too loose a criteria for JOINing, since dBASE II will allow only 65,535 records in a data base. JOINing all the records of two 100-record data bases does *not* create a 200-record data base; rather, it creates one with 10,000 records.



The INDEX and SORT commands are a common area of interest and debate, since they perform one of the most desired tasks of a data base—putting things in order. The INDEX command works quite well on the whole. dBASE II can find a record, even in a very large indexed data base on a floppy disk system, in about two seconds.

There are, however, some things to remember about indexing. Theoretically, dBASE II can keep track of up to seven indexes simultaneously, but realistically this isn't possible. On large files, regular use of more than two indexes at once is not practical, because it takes too long (see the sidebar on indexing speed).

PROGRAMMING

All dBASE II commands can be placed in standard carriage return/line feed delimited text files (created using either the user's favorite text editor or dBASE II's internal editor). These files can subsequently be "run," thus performing tasks automatically. Everything from screen and printer I/O to machine language subroutine execution can be handled using programs.

Program structure is similar to that of Pascal and other "structured" languages. Line numbers are not used, and program flow is essentially "top down," although, as with Pascal and C, portions of DO WHILE loops may be circumnavigated to get back to the top of an active DO WHILE. IF-ELSE-ENDIF, DO WHILE-ENDDO, and DO CASE constructs are all available.

The language supports a degree of modularization, in that one "command file" (program) may call another, which may call another, and so on. However, the modularization is not as extensive as it could be. For example, the creation and calling of "procedures" within a single program is not supported. Each procedure must therefore exist as a separate entity on disk and must be opened and closed by the operating system, which slows execution. The alternative is to merge the called program into the calling program wherever it is needed. This may be done using an editor or via a utility program.

To complicate matters, all dBASE II memory variables are "global" in nature. This means that they are available to any program that is currently executing. If care is not taken in naming and/or clearing variables, two programs may collide by modifying data in each other's variables.

dBASE II, unlike many other languages, is not supplied with a compiler. As a result, programs run more slowly, consume more disk space, and are easily plagiarized by others. The RunTime pseudocompiler available from Ashton-Tate solves this problem to some degree (see below), but with a list price of $700, dBASE II should be able to create fast, executable, stand-alone programs; support procedure calls; and include a linker and formatter. Most languages offer these features, often at no extra charge.

On the plus side, interactive screen activity is easy with this language. Don't overlook the use of the ACCEPT, WAIT TO, and INPUT commands, which require less coding than @ SAY, GET, and READ. Also, when it comes to formatting things like social security numbers, phone numbers, and dates, be sure to use the PICTURE phrase with GETs to control the format in which the data should be provided. For example:

```
@10,10 GET date
  PICTURE "  /  /  "
```

Another area in which dBASE II shines is data validation of input. Aside from testing input using IF or DO CASE procedures that can filter *any* invalid data (such as an illegal menu choice), there are a few other techniques. For example, using

```
GET mvar PICTURE "9999"
```

will prevent letters from getting into a field. Or use the uppercase function, which will prevent lowercase letters from sneaking into a data base:

```
GET mvar PICTURE!!!!!
```

Here are several dBASE II system parameters that the user should consider when he is concerned about insuring data entry validity:

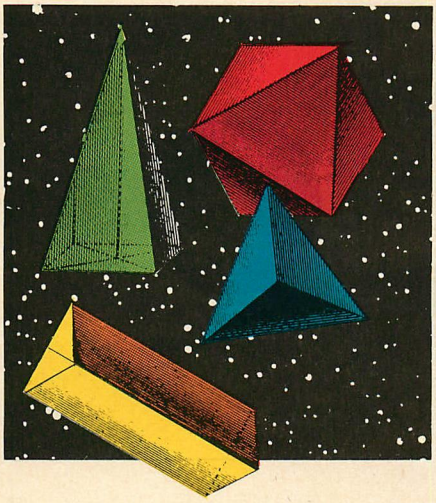
SET BELL [ON/off] When ON, the terminal's bell rings if invalid data are entered or data field boundary is passed.

SET CARRY [OFF/on] When ON, data in current record are carried over to the next APPENDed record in full-screen mode. Eliminates repetitive typing (and mistakes).

SET COLON [ON/off] On displays colons at beginning and end of variables on screen.

SET CONFIRM [OFF/on] When ON, a carriage return is required to move from one field to the next; otherwise automatic skipping is done.

SET ESCAPE [ON/off] ON allows user to abort execution of a program by hitting the ESCape key. Better to set this off.



SET EXACT [OFF/on] ON requires exact matches in any comparison of character strings (in FOR <exp>, FIND commands, etc.). OFF allows matches between character strings of different lengths, e.g., 'ABC' = 'ABCDEFG.

Assets and Liabilities

Within dBASE II's basic specifications (see table 1), the first and most discussed limitation is the 32-field maximum. At first glance this may not seem a problem, but many complex applications can quickly outstrip this number. If a user is creating a personnel file that should contain lots of information about each person, he just may run out of fields.

There are several ways to work around these limitations. Since dBASE II allows two data base areas (primary and secondary) to be open simultaneously, a little tricky programming using the SET LINKAGE ON command can result in what appears to be one data base with 64 fields. The LINK command causes the record pointers in each file to move in unison. However, extra care is required when using the arrangement, because accidental DELETion of a record in one data base followed by a PACK command will result in a mismatch between primary and secondary records.

Another approach is to pack several fields worth of data into each field, using dBASE II's substring function for storage and retrieval of the various portions. However, rapid access and entry of data will almost certainly require the use of dBASE II programs in this case, and these programs will necessarily be more complex than usual.

The third alternative is to use one field in the master file as a key to an INDEXed second file, which could in turn contain a key to a third file, and so on. In this manner, any number of files can be linked together in a hierarchical fashion, thus giving the appearance of more fields. However, access time increases dramatically (because of the opening and closing of disk files), as does programming overhead. Things would be much simpler if dBASE II simply allowed for, say, 64 instead of 32 fields.

The experienced programmer will undoubtedly balk at the next considerable constraint—that of having only 64 memory variables active at any one time. A high price is paid for dBASE II's ability to run in 128K of RAM (on the IBM PC). Most of this memory is used for the program itself, and portions of data files are shuffled to and from disk.

This trade-off requires a prudent approach to variable usage, which, as of dBASE II revision 2.4, has been eased by the expansion of the RELEASE, SAVE, and RESTORE commands. It is now possible to specify particular subsets of a current memo-

ry variable list when clearing variables and when saving them to disk. Also, using the ADDITIVE phrase, it is now possible to subsequently restore variables to memory without clearing out existing variables. Here are some examples (assume that Z, Z2, X, X1, X2, X10, X11, and X111 are variables in use):

RELEASE ALL LIKE X? (Z, Z2, X10, X11, X111 will remain)
SAVE TO MEMLIST ALL LIKE X?? (X10, X11 will be saved to disk)
RELEASE ALL LIKE X?? (X10, X11 will be cleared)
RESTORE FROM MEMLIST ADDITIVE (Variables now consist of Z, Z2, X10, X11, X111)

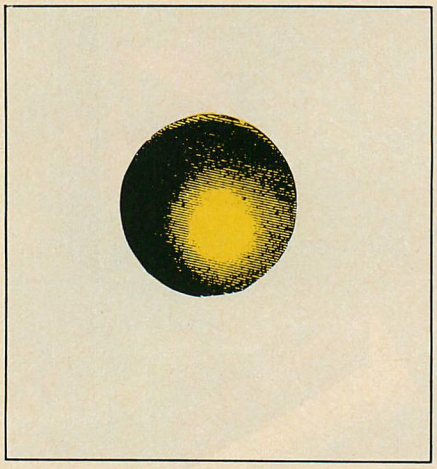
Still, more care is required with dBASE II memory variables than with other high-level languages. An additional drawback, one that is possibly more restricting, is dBASE II's inability to create and use memory variable "arrays" as other popular programming languages, such as BASIC and Pascal, do. Those who are already proficient programmers and who are used to these features will find this shortcoming a nuisance. However, there is a way around this, to some extent, using macro substitution to create indirectly referenced quasi-arrays. Here is an example:

```
. store 50 to n
. store "L"+str (n,2) to keeper
. store "Hello" to &keeper
. display memory
N          (N)   50
KEEPER     (C)   L50
L50        (C)   HELLO
```

By adding 1 to n and repeating these commands, we could create any number of variables (up to 64), named L51, L52, L53, etc.

As for assets, most all the other parameters are acceptable, if not laudable, limits. Being limited to 99 bytes in an index key may occasionally cause difficulty, but dBASE II does allow keying on a substring of a key field, which could solve that one.

Users who like to create extremely dense screens for data entry may have problems with the limit of 64 pending GETS (areas on the screen in which data are entered). However, since the maximum number of field variables available for data storage at any one time amounts to 64, why bother? Besides, the CLEAR GETS command may be issued after one batch of data is captured, allowing for a new set of 64.



DEBUGGING

dBASE II has no shortage of error messages. The only problem is that most of us see only the ubiquitous SYNTAX ERROR complaint, which dBASE II generates when it is totally confused. However, three helpful features are the option to change a portion of a command line rather than retyping the whole thing until it executes, dBASE II's positioning of a question mark above the command-line word that caused the error, and the reporting of the program name to the screen if the objectionable command was encountered during execution of a program. This makes finding the error with a text editor easy.

SET DEBUG [OFF/on] ON sends output created by **ECHO** and **STEP** options to printer. **OFF** sends this output to the screen.
SET STEP [OFF/on] ON aids debugging of command file by halting execution at each command in file. **OFF** does not halt execution.
SET ECHO [OFF/on] ON enables monitoring of command file execution by echoing all commands to screen. **OFF** sends no report on execution.

If all three of these are set on, the user should not have any trouble finding exactly where a program is crashing. However, that is not always informative. Using proper indenting for IFs, ENDIFs, DOs and ENDDOs can be of more help. Often dBASE II gets confused to the point that the error messages are of no help. A program called dUTIL is available from Fox and Geller and is pretty good at formatting command files and looking for logic errors.

Ever had an error message on a line that you knew was correct as it was? Sometimes a high bit on that line gets set accidentally, either by a word processor or through some other fluke. Try eliminating that line altogether and then retyping it or using a utility that strips the highest bits.

PERFORMANCE

Data base management on microcomputers can be frustratingly slow. Because dBASE II has so little RAM to work with (relative to data base file size), it resorts to juggling files back and forth between disk and RAM. Normally, only a small portion of a data base can be read into RAM at one time, not to mention dBASE II overlay files, command files, the HELP file, and associated indexes. When it comes time to INDEX or SORT, things really slow down unless a large RAM disk is available.

Editing can also be a problem. When editing with an index open, dBASE II looks to see if key fields have been changed. If so, the appropriate indexes are updated. APPENDING with several indexes open is sufficiently fast, but EDITing in the same environment may be prohibitively slow because index files require more shuffling when existing

records are altered than when new records are simply being added during APPEND.

If the READ and REPLACE commands are being used with memory variables to EDIT under program control, dBASE II will always update the indexes, even if no fields are altered. To get around this, use the undocumented command NO UPDATE along with the READ and REPLACE. dBASE II will then be directed not to perform disk accesses when non-key data are changed.

To get an idea of the relative speed of various disk-intensive operations, I compiled a 300- and 1000-record mailing list and clocked a number of operations (all tests were run using files on the default drive for best possible performance). The results are shown in table 2. References to indexes refer to the number of indexes in use (updating) at the time of measurement. These benchmarks were performed on an IBM PC with 192k RAM, two double-sided disk drives, and PC-DOS version 1.1.

Speed Limits

If execution speed turns out to be a critical problem, there are several ways to speed up the program. First, eliminate irrelevant code from the files, including all comments, tabs, and extra blank lines. Then shorten all command words (not field or variable names) to the first four letters, because that is all dBASE II looks at anyway.

Next, if there are lots of small programs that call one another, try putting them into one file. If the resulting program is monstrous, this may not speed things up—it might even slow the programs down—but it's worth a try. (Keep a back-up copy of originals just in case.) Next, use a utility program to copy the most used programs and files onto a blank disk. These programs will be recorded on consecutive tracks, which cuts down on disk drive head seek time.

Beware of using multiple indexes, as this slows things down considerably. Any command that opens, closes, or references a file or index takes time. If an index is used only occasionally, have the program reindex once a week or when the computer is not in use. Using the USE <CR> command to write the RAM buffer out to disk is a good idea, but in moderation. Finally, if you access a particular index frequently, SORT the data base it references regularly, using the same key your index uses. Then rename and reindex the new file. The index will work faster because there will be less disk activity when FINDing, LISTing, etc.

Index files require much less disk space than do the .DBF files they reference. Aside from greatly increasing the speed with which dBASE II FINDs records, index files also save disk space when compared to sorted files (see table 3 for a typical example of the space saved).

If a user is concerned about whether a particular data base file will fit in the available disk space, this formula will help him decide:

SIZE in KILOBYTES = ((record size X number of records) + 521)/1024

The DISPLAY STRUCTURE command can be used to determine the record size.

Operating System Control

It can be very inconvenient to exit from a program in order to perform a little system housekeeping. Convenience is an important factor when regularly using a program like dBASE II because getting in and out takes time. Luckily, some—though not enough—system utilities are built

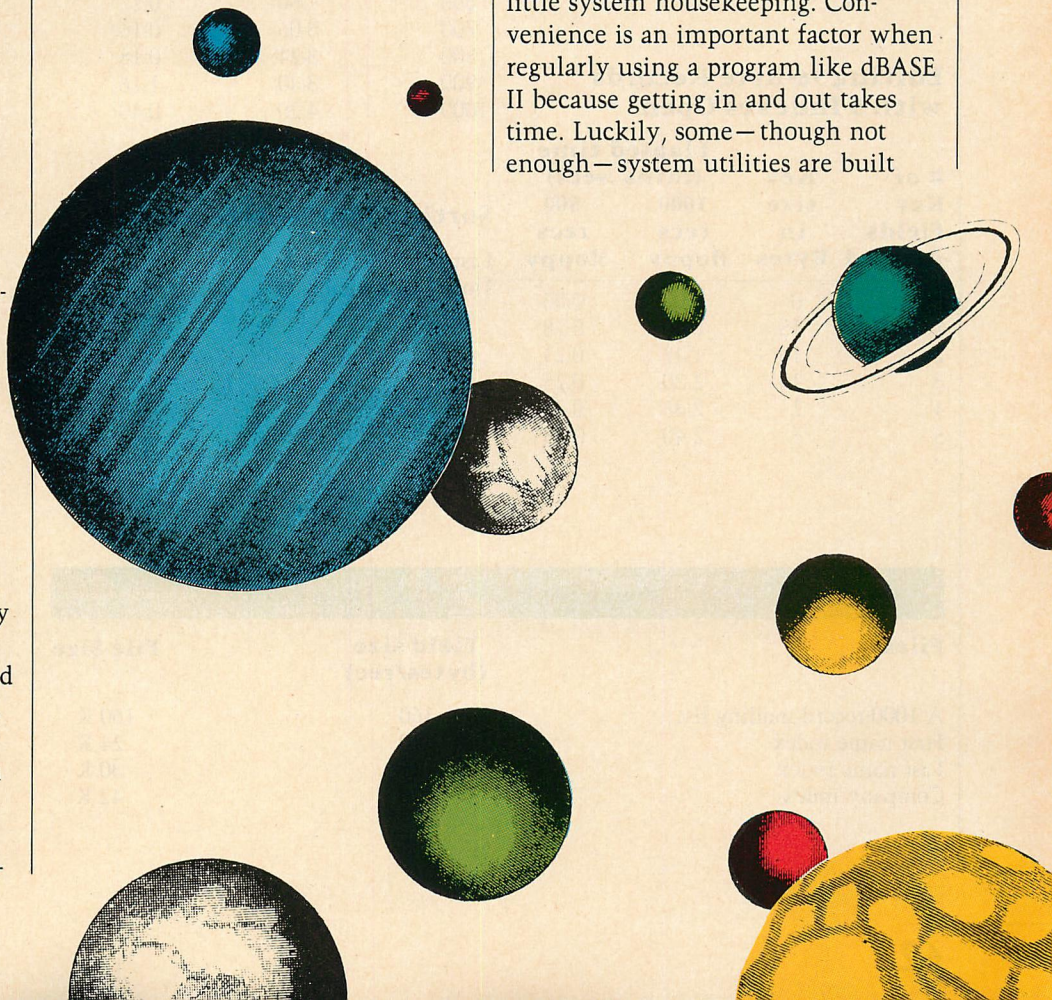


Table 1: dBASE II Basic Specifications

Maximum number of fields per record	32
Maximum number of characters per record	1000
Maximum number of characters per field	254
Maximum number of records per data base	65535
Maximum number of characters per character string	254
Maximum number of memory variables	64
Maximum number of characters per command line	254
Maximum number of expressions in SUM command	5
Maximum number of characters in Index key	99
Maximum number of pending GETS	64
Maximum number of open data bases	2
Maximum number of open files (all types)	16
Maximum number of indexes open	7
Maximum Report header length	254
Maximum number of fields in Report	24
Accuracy of numeric fields	10 digits
Largest number	1.8 X 10**63
Smallest number	1.0 X 10**−63

Table 2: Benchmark Results on Floppy Disks

Appending Records

300 records	1000 records
0 indexes 0.2 sec	0 indexes 0.2 sec
1 index 0.7 sec	1 index 0.7 sec
2 indexes 1.5 sec	2 indexes 2.0 sec
3 indexes 2.4 sec	3 indexes 4.0 sec
4 indexes 2.9 sec	4 indexes 6.3 sec
5 indexes 3.4 sec	5 indexes 7.5 sec

Editing 96-Byte Records with 5 Indexes Open

# of Key Fields Altered	Key size in Bytes	Elapsed time (mins :secs) 1000 recs floppy	500 recs floppy
0	0	0:03	0:03
1	15	0:40	0:18
2	10	1:42	0:21
3	20	2:30	0:25
4	2	2:38	0:32
5	5	2:40	0:35

Indexing 1000 96-Byte Records

# of Recs	Elapsed Mins:Secs	Time Per 100 Recs
100	0:16	0:16
200	0:57	0:41
300	1:45	0:48
400	2:15	0:30
500	2:33	0:17
600	2:50	0:17
700	3:06	0:16
800	3:24	0:18
900	3:40	1:16
1000	4:20	0:40

Sorting 1000 96-Byte Records

Last name field (15 bytes)
Floppy disk total:8:33

Table 3: Space Saved by Using Index Files

Files	Field size (bytes/rec)	File Size
A 1000-record mailing list	160	160 K
First name index	10	24 K
Last name index	15	30 K
Company index	20	42 K

dBASE II Functions

dBASE II offers several interesting functions. Some of these are downright necessary; others are icing on the cake. All can be used inside or outside programs. The last one, TEST, is undocumented, but it can be used to prevent loss of program control when user input could cause a syntax error.

@	Reports the location of one string in another string
*	Deleted record function evaluates as a logical True if current record has been marked for deletion
#	Record number function gives value of integer corresponding to current record number
!	Converts lowercase to uppercase
$	Used to form a character string from a specified part of another character string
CHR	Yields the ASCII character equivalent of a numeric expression. For example, ? CHR(7) rings a bell.
DATE()	Returns the character string that contains the System Date in format xx/xx/xx
EOF	Indicates whether the end of the data base file in use has been reached
FILE	Can be used to determine if a specific file exists on a particular disk drive
INT	Rounds a number down to the nearest whole number
LEN	Returns the number of characters in a string
RANK	Returns the ASCII numeric value of the first character in a string
STR	Converts a numeric expression into a character string
VAL	Converts a character string of numerals into a numeric expression. For example, ? VAL ('12345').
TRIM	Removes trailing blanks from a string
TYPE	Reports whether an expression is character, numerical, logical, or undefined in nature
TEST	Function to determine if an expression is valid and usable by dBASE II

into dBASE II to make this easier. Some of these utilities are

DISPLAY FILES [ON <disk drive>] [LIKE <skeleton>]—lists files and allows wildcard searches

RENAME filename TO newfile—allows renaming a file from dBASE II

DELETE FILE filename—wipes



out the file named

?FILE <filename>—returns a 1 or 0, indicating whether a file exists on the disk. This can be used in a program.

Interfacing to Other Programs

With "operating environment" popularity on the rise, a new premium has been put on the ability of programs to share information. For example, can a data base file created in dBASE II be pulled into SuperCalc? How about doing form letters with MailMerge based on a dBASE II mailing list? Or creating a text file that documents the screen interactions during execution of a dBASE II program? Several dBASE II commands, listed below, can accommodate a few of these needs.

SET ALTERNATE TO [<file>]—creates a .TXT extension file that records screen output.

SET ALTERNATE TO closes the .TXT file. Good for writing documentation about a program.

SET ALTERNATE [OFF/on]—turns off and on the file specified in the command.

COPY TO <file> DELIMITED WITH ,—This variation of the **COPY** command will copy a data base into a text file with fields separated by commas. MailMerge needs to see commas as delimiters, but other delimiters may be specified. If any of the fields involved include commas, MailMerge will choke on them. Once in a text file, the user may have to use a BASIC or other program to eliminate unwanted spaces.

Second-Generation Products

The 16-bit releases of dBASE II, including the version for the IBM PC, are essentially translated versions of the 8-bit original. A few modifications were made to get them working. In the PC-DOS version, the function keys are used, the SET COLOR TO command has been added, and the command QUIT TO is not implemented.

On February 22, Ashton-Tate announced the development of a record-locking version of dBASE II for multiuser systems and for the 3COM local area network. This version should have been released in May.

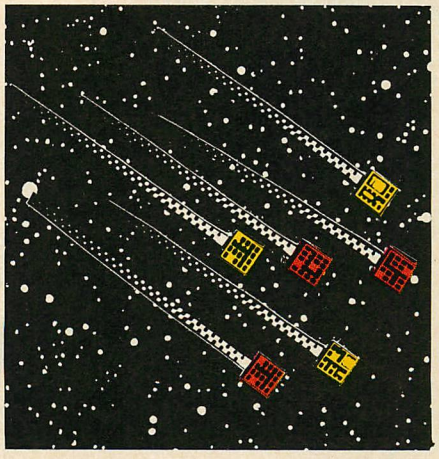
Plans for dBASE II version 2.8 for Unix operating systems are in the works; this version will probably be written in C. More memory variable space is promised, as well as more advanced relational commands, the ability to have up to four data files open at the same time, a utility for migration from less powerful versions, and 80 percent upward compatibility. Most likely, 128K memory (free) will be required.

Another new version, 2.41, for PC-DOS and CP/M, will support a tertiary data base area as well as the primary and secondary areas already available.

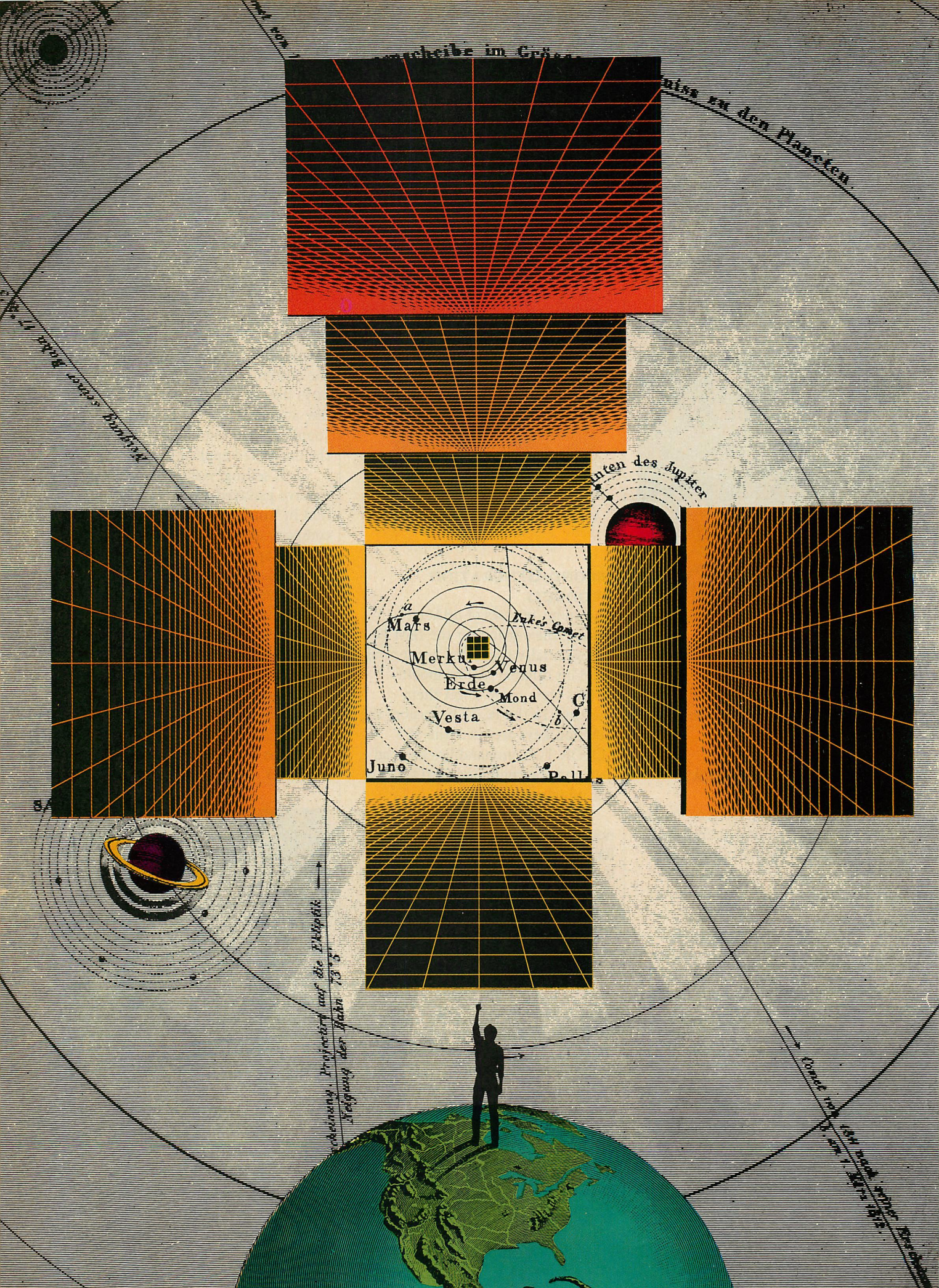
dBASE II RunTime is another product from Ashton-Tate. It is designed to assist programmers in marketing a software package written in dBASE II. The package allows encryption and running of the encrypted dBASE II applications without the need for the full-blown dBASE II program. This protects the developer's program and cuts costs for the customer. The software developer buys licenses for the RunTime module, at approximately $100 each, and supplies them to the customer with the encrypted application.

Is it selling? Ashton-Tate claims to have parlayed more than $1 million in RunTime licenses so far. The company also publishes a catalog of existing applications written in dBASE II and will provide software developers with other aids to the marketing effort.

Is it faster? Don't count on it. Execution speed of encrypted programs is increased by only about 20 percent, and this applies only to the program itself, not to external functions such as indexing. Command file size should be decreased by about 33 percent after encrypting.



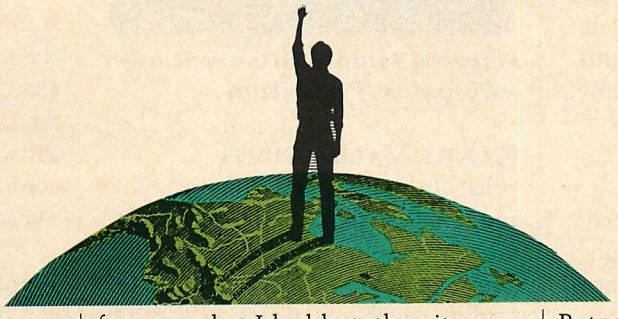
Of course, no encryption method is pick-proof, and already a decryption product has appeared on the market. But Ashton-Tate claims to be beefing up its secret formula—and then we'll have round two.


Mars
Merkur
Venus
Erde
Mond
Vesta
Juno
Pallas
Duke's Comet
a
b
C
unten des Jupiter

JAMES C. HANSEL

BOMB PROOFING

Built-in protection against incorrect input



From a computer dialogue overheard recently:

HOW MANY PLAYERS?:
TWO
SYNTAX ERROR, RE-ENTER:
two
SYNTAX ERROR, RE-ENTER:

This is an example (from a dBASE II program) of inadequate input validation. The operator has spelled the number instead of typing the digits as expected. Instead of a message from the program, we get an error message from dBASE II itself, and not a very informative or friendly one, at that. Input validation would result in a more sensible dialogue.

I once won thousands of dollars from a computerized blackjack game that lacked good input validation. All I had to do was to enter a negative amount as my wager, and then deliberately lose. The program would inform me that I had lost, then it would obediently subtract the negative amount from my balance, making me that much wealthier. Unfortunately, the game did not pay off in real money, but there are plenty of systems that do handle real money and that expose themselves to unexpected inputs daily. Imagine a home banking system that would allow the user to write a check for a negative amount to, say, the IRS.

One characteristic of a sophisticated computer software system is "bomb-proofing," or built-in protection against incorrect inputs. Any time a program asks for an input, it runs the risk that something completely off-the-wall will be typed in, instead of something from the limited set of expected answers. Whoever is operating your program, no matter what keys that person strikes, the program should be prepared to give an appropriate response. The response should be neither to crash back to the operating system, nor to bring up the dBASE II "Correct and Retry?" dialogue, nor to accept an input that will cause problems later.

In most cases, the program should respond to input politely and firmly with clear instructions for the operator. In many cases, even correct inputs should be acknowledged, not only giving positive feedback to the operator, but making clear just what the program has accepted and what it is about to do with it. This is known as "input validation," and it should be a part of every dBASE II application. What follows are some dBASE II validation programming techniques applicable to most forms of input.

HOW TO VALIDATE

Validation in dBASE II is usually accomplished using what could be called a *validation loop*. It is a DO WHILE loop controlled by a validation test. The actual input commands are within the loop, as are any messages used to respond to the input. These examples make heavy use of logical memory variables (memvars), DO WHILE loops, IF-ELSE-ENDIF

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constructs, and the @ SAY and @ GET commands in the dBASE II language. Anyone who has done some dBASE II programming should be fairly conversant with these parts of the dBASE II language. Those who are not might want to keep the dBASE II manual close by while reading these listings or try typing in and running the examples in order to fully see them in action.

Consider these three types of validation loops: the "simple" type validates a single entry (usually a character string) against a list of permitted values, the "range" validation tests an entry (usually a numeric value) against a maximum and a minimum legal value, and the "complex" validation validates a screenful of items together and can detect faulty combinations of otherwise legal entries.

SIMPLE VALIDATIONS

The most common questions asked by programs require a yes or no answer. This simple validation is shown in listing 1. The question here is whether the program should continue to process or should end, so a controlling logical memvar called "terminate" has been established, as have a character memvar called "answer" to accept the "Y" or "N" response and a logical memvar called "answered" to control the validation loop itself.

To make the program more readable, many comments are included. The examples observe the dBASE II style conventions. Version 2.4 of dBASE II for the IBM PC under PC-DOS is utilized.

The simple validation can be varied within the same pattern when the answer is not of the Yes/No type. Using the substring search function of the dBASE II language, an input string is easily tested against a list of legal values. For example, in testing for one of the first three months of the year, in the form of a three-letter abbreviation, the logical expression month$"JAN orFEBorMAR" would be used to test the input string "month" for legality. The use of the lower-case "or" in the list ensures that a month like "ANF" isn't accepted because it consists of the last two letters of "JAN" and the first letter of "FEB". A PICTURE "!!!" clause on the GET statement is used to restrict input to upper-case so no lower-case letters get into the month.

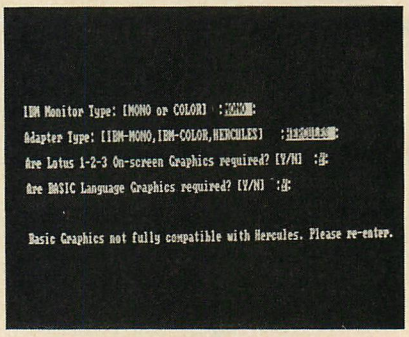


Figure 1: Sample Editing Session —Complex Validation

RANGE VALIDATIONS

What if the input is a numeric value, and it is desirable to validate it as falling within some defined "reasonable range" of values? For example, in recording weather statistics, it would be wise to prevent the entry of a temperature as 200 instead of 20 degrees.

Listing 2 shows a program fragment that accepts and validates the input of today's temperature, permitting a range of −99 to +150 degrees Fahrenheit. It also demonstrates a useful method of creating blinking attention-getters to highlight an error message. The attention-getters can be used in any type of validation.

COMPLEX VALIDATIONS

The real power of the generalized validation algorithm is demonstrated in the complex validation. A complex validation also uses a DO WHILE loop controlled by a logical test, but the complexity of the test is increased, and there are many possible error messages; as many, in fact, as there are possible errors.

When there are many items on an input screen, the range of legal values for any one item may depend on the value of one or more of the other items. How can an entry be validated when its legality cannot be determined until some later entry has been accepted?

In a complex validation, there will be several GETs active on the screen at once, controlled by one READ statement. The READ, as in the simple validation, will be within a DO WHILE loop and will be followed by a DO CASE structure containing as many tests of possible error conditions as are necessary. As in the simple validation, each CASE condition is accompanied by the appropriate processing, which may include error messages, setting of flags (logical memvars), and @ GET statements to put the cursor back in the field that is in error and to permit re-entry of the offending item. Listing 3 is an example of a Complex dBASE II Validation that checks the hardware and software compatibility of an IBM PC configuration. Figure 1 shows a sample editing session.

Of course, these examples are simplified. Some additional features could be built into a validation loop. One would be a counter, to limit the number of unsuccessful entries permitted. To validate a password, however, we might wish to "throw the bum out" after three unsuccessful tries at entering the correct password. This is best accomplished by use of an "abort" flag, a logical memvar called "abort." The validation loop would then be controlled by the logical expression

((.not. valid) .and. (.not. abort))

and a counter would be initialized outside the loop, incremented after each READ, and tested in the first CASE statement. If the counter exceeded three, the abort flag would be set true, causing the validation loop to end. Of course, the code following the validation loop would have to check the abort flag before it continued normal processing.

Another important optional feature of a validation loop is the "escape hatch" capability. One way to permit cancellation of the validation

is to permit an item to be entered as all blanks and then to set the "abort" flag instead of the "valid" flag.

The Price

The operation of a good validation loop is marvelous to behold. It causes a program to exhibit a tough and unwavering sort of intelligent behavior. There is a price for this, however.

The logic of a complex validation loop must be rigorously thought out and then tested thoroughly. All it takes is one unforeseen combination of inputs to break a system. Also, the reasoning behind the validation logic should be explained carefully in comments. There is also the matter of execution time. If a validation loop such as this complex example requires page after page of error tests, the execution time can stretch to several seconds. Small examples like these execute almost instantaneously; large CASE structures take time.

Conclusion

Most system designers will accept the execution speed penalty as a reasonable price to pay for the protection afforded their systems by the validation of all inputs. Validation loops are an elegant and effective way to increase the sophistication of any interactive system we build, and there is hardly any PC system that does not include considerable operator interaction. Validation loops can be as fancy as desired, and users will appreciate their "intelligent" behavior.

Let's not have any more systems that allow users to specify negative blackjack bets or negative checks to the IRS (well, maybe we should make one exception, after all).

Listing 1 Simple Validation Loop

```
SET TALK OFF
ERASE
STORE f TO terminate
* - controls repetition of the entire program
DO WHILE (.not. terminate)

   *(
   *( The bulk of the program would
   *( go here, within the major loop
   *( controlled by the logical
   *( memvar "terminate" - the validation
   *( loop appears below
   *(

   ***********************************************
   * - VALIDATION LOOP
   * - obtain a valid Yes or No answer

   * - create the memvars "answer" and "answered"
   STORE "Y" TO answer
   STORE  f  TO answered

   * - clear the screen
   ERASE

   * - ask until a proper answer is given
   DO WHILE .not. answered

      * - ask the question...
      @ 10,5 SAY "Do you wish to continue? (Y/N)"

      * - get the answer, forcing it to upper case
      @ $,$+2 GET answer PICTURE "!"
      READ

      * - deactivate the GET field
      CLEAR GETS

      * - erase any previous error messages
      @ 10,0
      @ 11,0

      * - test the answer, respond appropriately
      DO CASE

         * - if the answer is NO:
         CASE answer = "N"
            * - we have a valid answer, and
            STORE t TO answered
            * - the answer means we should terminate
            STORE t TO terminate
            ERASE
            * - we show that we are terminating
            @ 10,10 SAY "Terminating, please stand by."

         * - if the answer is YES:
         CASE answer = "Y"
            * - we have a valid answer, and
            STORE t TO answered
            * - the answer means we don't terminate
            STORE f TO terminate
            * - we indicate that answer has been accepted
            @ 11,10 SAY "Continuing."

         * - the answer was something else (anything)
         OTHERWISE
            * - we don't yet have a good answer
            STORE f TO answered
            * - we ask for a better answer
            @ 11,10 SAY "Please answer Yes or No....."

      ENDCASE

      * - try again if "answered" is still false
   ENDDO - while not answered

   * - release the loop variables
   RELEASE answer, answered

   ERASE

ENDDO - while not terminate
RELEASE terminate

* - terminate the program
QUIT
```

Listing 2 Range Validation Example

```
SET TALK OFF
ERASE

* - Validate the temperature in degrees Fahrenheit
* - initially, the condition "valid" is not true
STORE f TO valid

* - initialize memvar for the temperature
STORE 0000.0 TO todaystemp

* - the loop repeats until a valid temperature is entered
DO WHILE (.not. valid)
   CLEAR GETS

   @ 10,10  SAY "Please enter today's temperature "
   * - "todaystemp" is a numeric memvar
   @ 10,$+2 GET todaystemp PICTURE "9999.9"
   @ 10,$+2 SAY "degrees Fahrenheit"
```

```
   READ
   CLEAR GETS

   * - erase any old error message from line 11
   @ 11, 0

   * - this is the actual range check
   IF ( ( todaystemp < -99 ) .or. ( todaystemp > 150 ) )

      * - if the number is out of range, put out the message,
      * - surround it with blinking arrows, and ring the bell
      @ 11, 17 SAY "Wild weather!  Please check that temperature."

      * - on an IBM PC, these color numbers cause blinking
      SET COLOR TO 120,158
      @ 11, $+2 SAY "<<<<<"
      @ 11, 11  SAY ">>>>>"

      * - reset to normal colors
      SET COLOR TO 120,7

      * - ring the bell (or beep)
      ?? CHR(7)

   ELSE - range check passed

      * - the temperature input is valid
      STORE t TO valid

   ENDIF - range check
ENDDO - while not valid
RELEASE valid
QUIT
```

Listing 3 Complex dBASE II Validation

```
ERASE
SET TALK OFF

* - initialize memvars to required size for each item
STORE "     "     TO monitor
STORE "         " TO adapter
STORE " "         TO lotususer
STORE " "         TO basicuser

CLEAR GETS

* -- bring up data entry screen
@  5, 5  SAY "IBM Monitor Type: [MONO or COLOR]"
@  5,40  GET monitor   PICTURE "!!!!!"
@  7, 5  SAY "Adapter Type: [IBM-MONO,IBM-COLOR,HERCULES]"
@  7,51  GET adapter   PICTURE "!!!!!!!!!"
@  9, 5  SAY "Are Lotus 1-2-3 On-screen Graphics required? [Y/N]"
@  9,57  GET lotususer PICTURE "!"
@ 11, 5  SAY "Are BASIC Language Graphics required? [Y/N]"
@ 11,50  GET basicuser PICTURE "!"

* -- perform the validations
STORE F TO valid
DO WHILE .NOT. valid

   * - read in the active data items
   READ
   * - erase previous error message
   @ 15, 0

   * - give operator a chance to change any of the entries
   STORE "Y" TO ready
   @ 13, 5  SAY "Ready to validate ? [Y/N]" GET ready PICTURE "!"
   READ
   CLEAR GETS
   * - erase the ready message
   @ 13, 0
   *
   * - in the DO CASE structure, ONLY the FIRST CASE with a true condition
   * --- will be executed---then the others are skipped, down to the ENDCASE
   DO CASE

      * -- Each CASE represents a possible error condition
      * -- If none of the cases is true, the OTHERWISE statements are
* -- executed.  Only then (no error cases) is the valid flag set true.

* - check the ready flag, reissue GETs if not Y
CASE ready<>"Y"
   * - re-enter all items
   @ 15, 5  SAY "You may re-enter any item."
   @  5,40  GET monitor   PICTURE "!!!!!"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"
   @  9,57  GET lotususer PICTURE "!"
   @ 11,50  GET basicuser PICTURE "!"

* - the next four cases are simple validations of each item
* -- using the substring search function
CASE (.not. monitor$"MONO orCOLOR")
   @ 15,5   SAY "Monitor must be 'MONO' or 'COLOR' -- Please re-enter."
   @  5,40  GET monitor   PICTURE "!!!!!"

CASE (.not. adapter$"IBM-MONO   orIBM-COLORorHERCULES ")
   @ 15,5   SAY "Re-enter 'IBM-MONO, IBM-COLOR, or HERCULES'"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"

CASE (.not. lotususer$"YN")
   @ 15,5   SAY "Please answer Y(es) or N(o)."
   @  9,57  GET lotususer PICTURE "!"

CASE (.not. basicuser$"YN")
   @ 15,5   SAY "Please answer Y(es) or N(o)."
   @ 11,50  GET basicuser PICTURE "!"

************************

* - the next two cases validate hardware compatibility....
CASE (monitor="MONO " .and. adapter="IBM-COLOR")
   @ 15,5   SAY "Mono monitor not compatible with Color adapter."
   @ 15,$+2 SAY "Please re-enter."
   @  5,40  GET monitor   PICTURE "!!!!!"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"

CASE (monitor="COLOR" .and. adapter<>"IBM-COLOR")
   @ 15,5   SAY "Color monitor requires Color adapter."
   @ 15,$+2 SAY "Please re-enter."
   @  5,40  GET monitor   PICTURE "!!!!!"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"

************************

* - the final three cases validate software compatibility....
CASE (lotususer="Y" .and. adapter="IBM-MONO ")
   @ 15,5   SAY "IBM Mono adapter not compatible with Lotus Graphics."
   @ 15,$+2 SAY "Please re-enter."
   @  5,40  GET monitor   PICTURE "!!!!!"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"
   @  9,57  GET lotususer PICTURE "!"

CASE (basicuser="Y" .and. adapter="IBM-MONO ")
   @ 15,5   SAY "BASIC Graphics not available on IBM Mono adapter."
   @ 15,$+2 SAY "Please re-enter."
   @  5,40  GET monitor   PICTURE "!!!!!"
   @  7,51  GET adapter   PICTURE "!!!!!!!!!"
   @ 11,50  GET basicuser PICTURE "!"

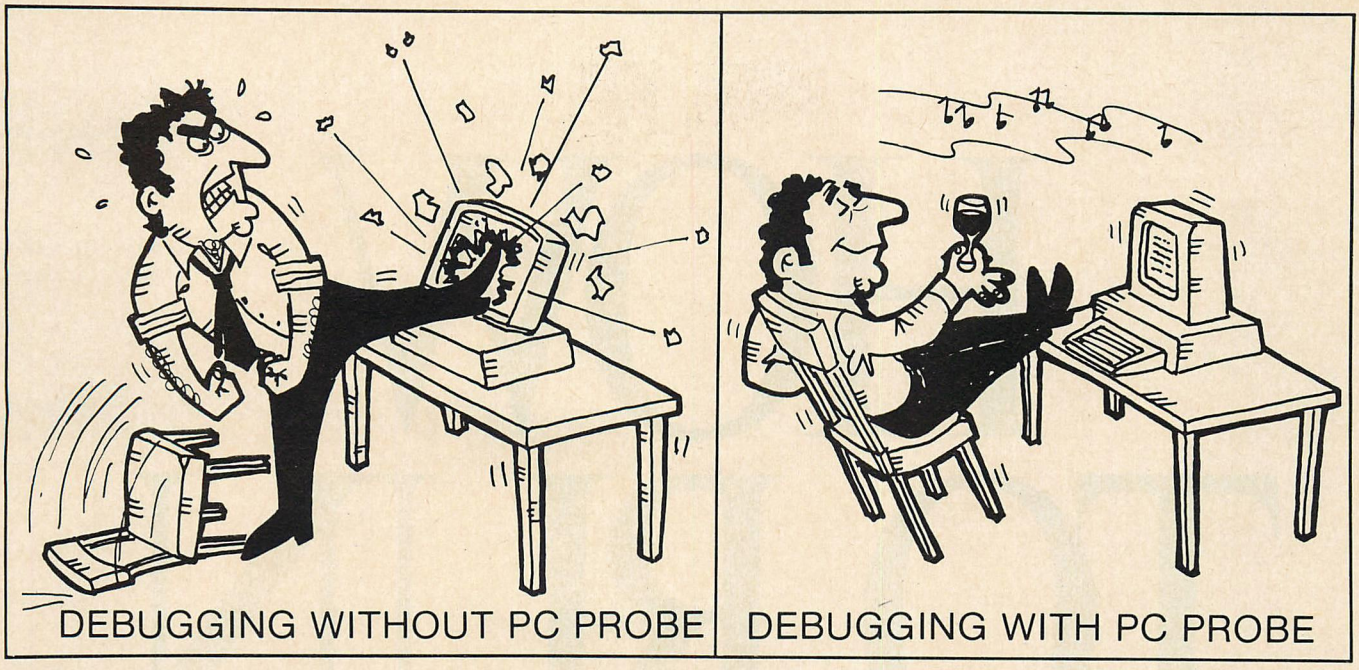
CASE (basicuser="Y" .and. adapter="HERCULES ")
      @ 15,5   SAY "Basic Graphics not fully compatible with Hercules."
      @ 15,$+2 SAY "Please re-enter."
      @  5,40  GET monitor   PICTURE "!!!!!"
      @  7,51  GET adapter   PICTURE "!!!!!!!!!"
      @ 11,50  GET basicuser PICTURE "!"

   *******************************

   OTHERWISE
      * - if none of the CASE conditions was true, data is valid
      @ 15,5   SAY "CONFIGURATION IS FULLY COMPATIBLE AS SHOWN."
      STORE T TO valid

ENDCASE

ENDDO - while not valid
RELEASE valid, ready
QUIT
```



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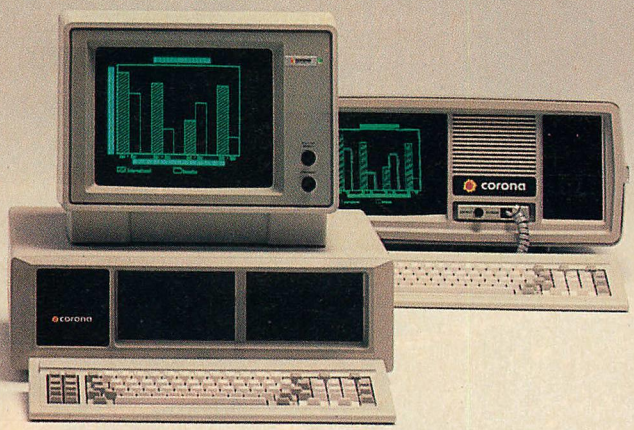
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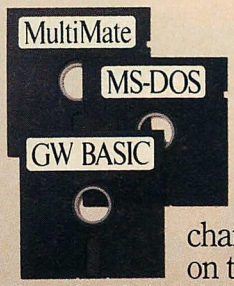
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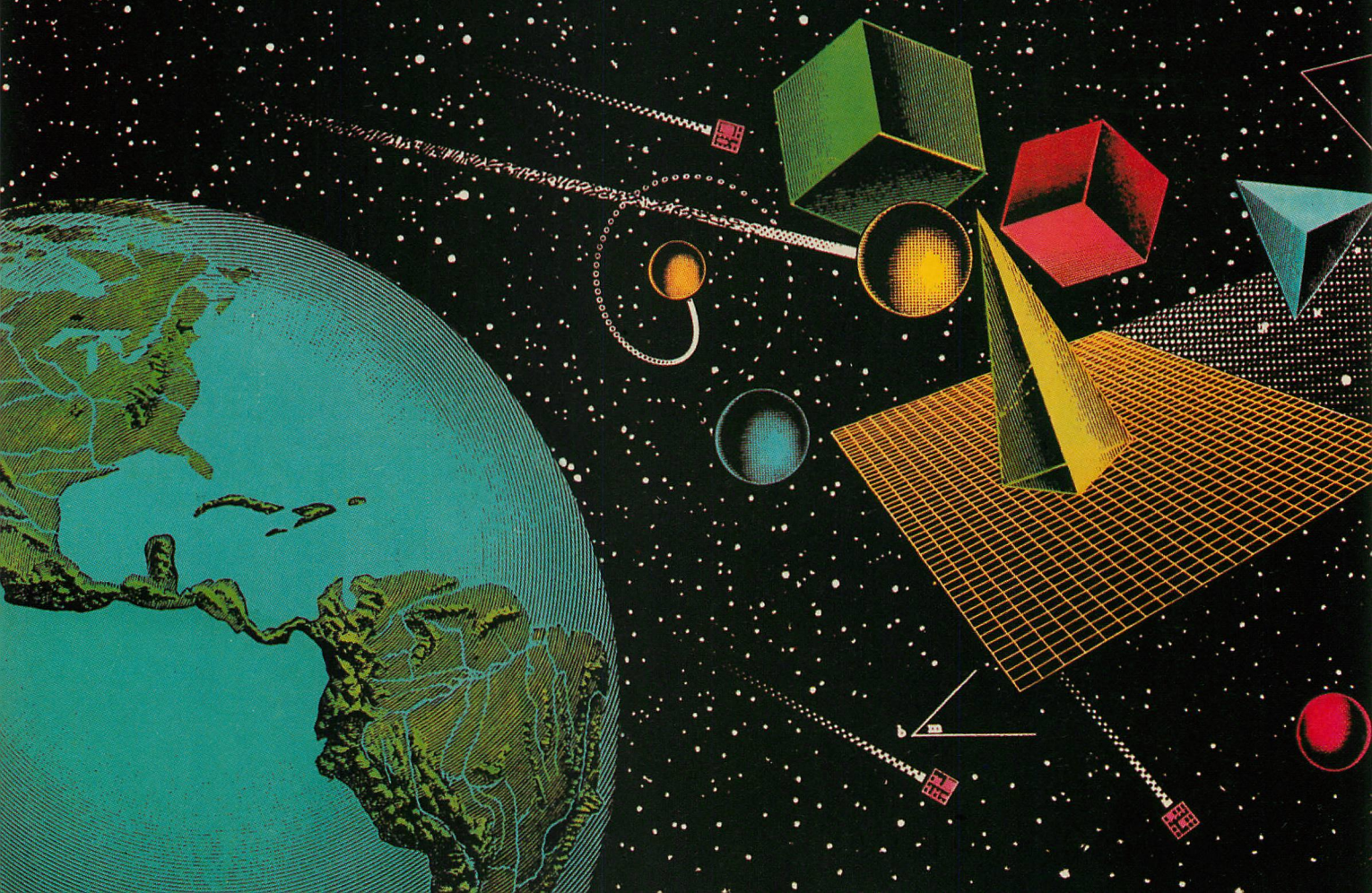
dBASE II Programming

PETER LAKNER AND DOUG SHERMAN

Tips for maintaining the integrity of multiple indexes

Anyone writing dBASE II applications of any considerable size or complexity has encountered difficulty in maintaining the integrity of multiple indexes. There are several aspects common to most such problems: a need to use more than seven indexes at one time; increased execution time because of frequent packing and reindexing; loss of records during a PACK; and an increase in the number of "Record Out Of Range" errors.

The method outlined below eliminates problems caused by the seven-index limitation and minimizes those caused by increased execution time, loss of records during a PACK, and "Record Out Of Range" errors. These methods allow the user to maintain more than seven index files for the same .DBF file without constant reindexing and packing. Packs and reindexing are reserved for monthly (or any user-chosen period) maintenance, which provides improved execution time and greater data/index integrity. (This technique will be especially useful for users of dBASE II versions prior to 2.4.)



Techniques

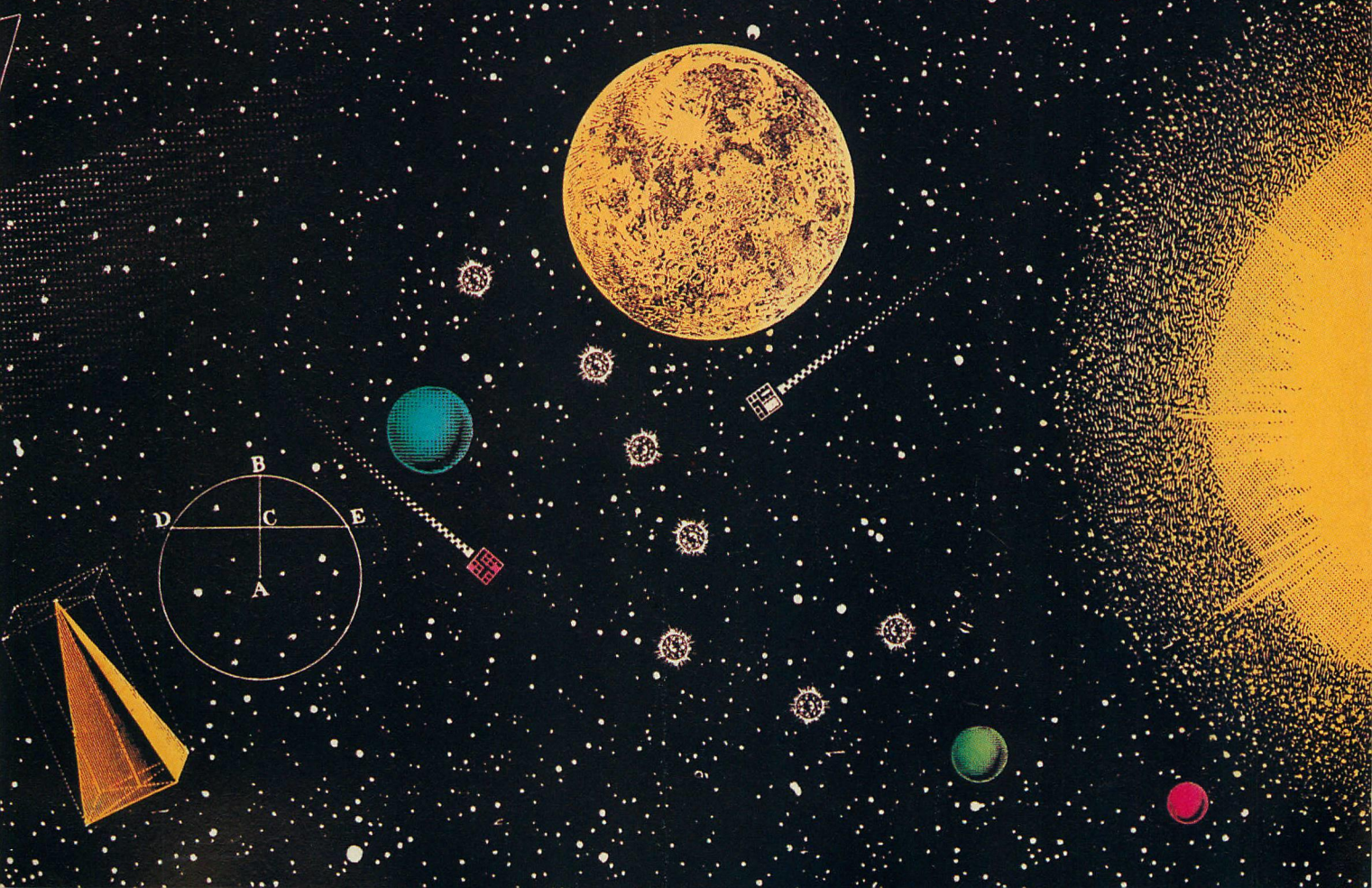
Using More Than Seven Index Keys

As every dBASE II programmer knows, up to seven indexes may be updated simultaneously. Many applications require access to the data base by more than seven keys. The approach most programmers use when they are trying to access data by the eighth (or ninth) key is to reindex the file by that specific key. This process can take a long time.

Our example program (see tables 1 and 2 and listing 1) uses 7 + 1 indexes, with social security number as the eighth. The concept is to maintain as the eighth index key a separate .DBF file containing only the data items being used. This file, which is indexed on this one key, is maintained so that its record numbers correspond to those in the main .DBF file. If there is a problem with available disk space, the eighth key can be omitted from the main .DBF file, provided that the field(s) is not part of any of the first seven index keys. More than seven index keys can be employed if the user abides by the instructions listed on the following pages.

Peter Lakner supervises all software development (primarily dBASE II applications) for Micro Clear, Inc., in the New York City area. Douglas Sherman is a dBASE II and C programmer who has supervised design and implementation at the systems level.

ILLUSTRATIONS • JOHN PACK



Maintaining the Special Key File(s). When APPENDing to the main .DBF file, USE the special key file and append a blank record to that file as well as to the .DBF file.

When READing or REPLACing the eight key value, perform the READ or REPLACE on the main .DBF file and then STORE the record number and the new value of the eighth key field to memory variables. Next, USE the special key file, GOTO the record number stored in the memory variable, and REPLACE the field with the new value.

When DELETing a record, first delete the record in the main .DBF file, then GOTO the corresponding record in the special key file and delete it there as well. See listing 1 which shows a typical maintenance program, for examples of these procedures. The logic used above could, of course, be adapted for use with other types of editing.

Accessing Data by the Eighth Key Field. To FIND a record by the eighth key, USE the special key file and FIND the indicated record. STORE the record number to a memory variable. USE the main .DBF file and GOTO the value contained in that memory variable.

If access to additional records with the same key is necessary, instead of doing a SKIP, USE the special key file and GOTO the corresponding record. Then perform a SKIP and GOTO the record in the main .DBF file (whose record number is now contained in the memory variable last saved through the previously outlined technique). See listing 2 for an example of this technique.

To keep our examples easy to understand, we have used only one additional index. Obviously, the special key file may also be indexed on up to seven keys, though any of the key fields must be present in this file. If



more than 14 indexes are required, a second special key file must be made.

Deletion And Pack

Prior to the release of version 2.4, dBASE II had no internal provision for ignoring those records marked for deletion. Performing a PACK after every DELETE can take an inordinate amount of time. Records can also be lost through this procedure.

Version 2.4 of dBASE II includes a SET option that ignores all deleted records (SET DELETE ON). For all earlier versions, the following technique accomplishes the same thing. There are two advantages to using this technique: it provides more efficient utilization of operator time (no more waiting for PACK after every deletion) and offers greater protection against data loss. Back-ups of all files should be made prior to the periodic PACKs that we recommend; this back-up provides protection against the loss of data that PACK can cause and is advisable for users with version 2.4 as well as earlier versions.

All records marked for deletion ("*") are considered nonexistent. When searching for a record (or records) matching a specific criteria, this method searches for those records that do match and aren't deleted. In any report, the marked records are likewise ignored (usually with a SKIP). See listings 1 and 2 for examples of this method.

The technique outlined above should enable the experienced dBASE II programmer to greatly expand and enhance the scope and functionality of his applications. It is by no means a structure upon which others could build an application. There are always unexpected contingencies and permutations that arise in specific applications, but this method should provide a solid framework for the most probable situations.

Table 1: File Structure for PEOPLE.DBF

STRUCTURE FOR FILE: PEOPLE.DBF
NUMBER OF RECORDS: 00003
DATE OF LAST UPDATE: 01/01/80
PRIMARY USE DATA BASE

FLD	NAME	TYPE	WIDTH	DEC
001	NAME	C	020	
002	SOCSEC	C	011	
003	BIRTH	C	008	
004	TEL	C	013	
005	ADDRESS	C	030	
006	DESCRIPT	C	030	
007	SALARY	C	010	
008	CATEGORY	C	001	
TOTAL			00124	

Table 2: File Structure for PEOPLE1.DBF

STRUCTURE FOR FILE: PEOPLE1.DBF
NUMBER OF RECORDS: 00003
DATE OF LAST UPDATE: 01/01/80
PRIMARY USE DATA BASE

FLD	NAME	TYPE	WIDTH	DEC
001	SOCSEC	C	011	
TOTAL			00012	



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Listing 1 MAINTAIN.PRG

```
* maintain.prg
*
*/this is a typical maintenance program used
*/with a data file indexed on 7 + 1 keys.
*/the eighth key is the social sec. no.  this
*/program gives the user the facility to
*/access a record by name and to review, update,
*/or delete the record.  the unique features are
*/the means by which we keep our special key
*/file (people1.dbf index soc) updated and
*/also the technique by which we ignore the
*/records marked for deletion.  the other
*/seven indexes are the fields in the structure
*/of people.dbf.
SET talk OFF
ERASE
STORE '                    ' TO vname
@ 10,00 SAY 'ENTER NAME YOU WANT ' GET vname
READ
CLEAR GETS
USE people INDEX name,birth,tel,add,desc,sal,cat
FIND &vname
*/this section checks for the existence of any
*/further records with this name and checks to
*/see if they are marked for deletion.
IF # = 0
    @ 12,00 SAY 'NAME DOES NOT EXIST. HIT RETURN'
    WAIT
    RETURN
ENDIF # = 0
STORE 1 TO t
STORE 1 TO nn
DO WHILE t = 1
    DO WHILE * .AND. name = vname .AND. .not. eof
        SKIP
    ENDDO WHILE * .AND. name = vname .AND. .not. eof
    IF eof .OR. name # vname
        IF nn = 1
            @ 12,00 SAY 'NAME IS DELETED. HIT RETURN'
        ELSE
            @ 12,00 SAY 'NO MORE RECORDS. HIT RETURN'
        ENDIF nn = 1
        WAIT
        STORE 0 TO t
        LOOP
    ENDIF eof .OR. name # vname
    STORE 0 TO nn
    ERASE
*/this section updates the record.
    @ 03,00 SAY 'NAME'
    @ 04,00 SAY 'SOC. SEC. # ' GET socsec
    @ 05,00 SAY 'DATE OF BIRTH ' GET birth
    @ 06,00 SAY 'TELEPHONE ' GET tel
    @ 07,00 SAY 'ADDRESS ' GET address
    @ 08,00 SAY 'SALARY ' GET salary
    @ 09,00 SAY 'DESCRIPTION ' GET descript
    @ 10,00 SAY 'CATEGORY ' GET category
    @ 03,05 SAY name
    READ
    CLEAR GETS
*/this section illustrates the technique for
*/updating the special key file (people1.dbf).
    STORE # TO rec
    STORE socsec TO vsoc
    USE people1 INDEX soc
    GOTO rec
    REPLACE socsec WITH vsoc
*/this section deletes record if desired.
    STORE ' ' TO yn
    @ 20,00 SAY 'DELETE THIS RECORD ? ' GET yn
    READ
    CLEAR GETS
    IF !(yn) = 'Y'
        DELETE
        USE people
        GOTO rec
```

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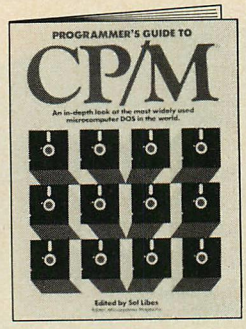
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```
        DELETE
    ENDIF
    USE people INDEX name,birth,tel,add,desc,sal,cat
    GOTO rec
    SKIP
ENDDO WHILE t = 1
USE
RELEASE ALL
RETURN
```

Listing 2 SOCACCESS.PRG

```
* socaccess.prg
*
*/this program shows how to access data
*/using the eighth key.
SET talk OFF
ERASE
STORE '           ' TO vsoc
@ 10,00 SAY 'ENTER SOC. SEC. # ' GET vsoc
READ
CLEAR GETS
USE people1 INDEX soc
FIND &vsoc
*/this section checks for the presence of
*/indicated records and ignores those
*/marked for deletion.
IF # = 0
    @ 10,00 SAY 'NO. DOESN'T EXIST. HIT RETURN'
    WAIT
    RETURN
ENDIF # = 0
DO WHILE .not. eof .AND. * .AND. socsec = vsoc
    SKIP
ENDDO WHILE .not. eof .AND. * .AND. socsec = vsoc
IF eof .OR. socsec # vsoc
    @ 12,00 SAY 'SS. # IS DELETED. HIT RETURN'
    WAIT
    RELEASE ALL
    USE
    RETURN
ENDIF eof .OR. socsec # vsoc
*/this section accesses the data in our
*/main .dbf (people.dbf)
STORE # TO rec
USE people INDEX name,birth,tel,add,desc,sal,cat
GOTO rec
ERASE
@ 03,00 SAY 'NAME'
@ 03,18 SAY name
RELEASE ALL
USE
RETURN
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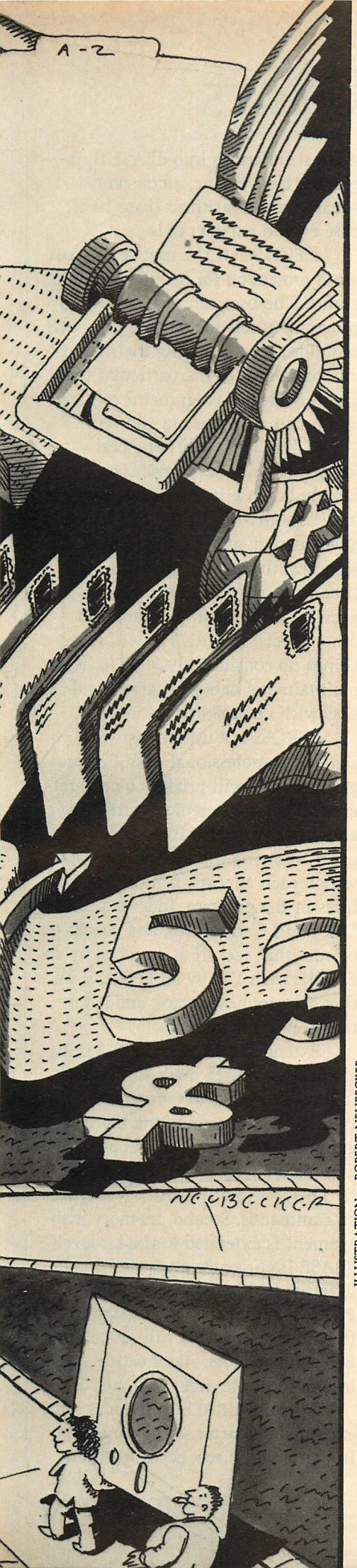


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SEVEN UTILITIES FOR dBASE II

Programs that make this standard product even more useful

Anthony K. Lima

With the explosion of interest in dBASE II has come a diverse set of utility programs. These utilities, broadly speaking, do one of two things: they either improve the efficiency of some aspect of dBASE II operations or give access to functions not available in dBASE II itself. Sometimes they do both.

I have been programming in dBASE II for about three years—since version 1.01 appeared—and I am therefore most interested in those packages that I think would be useful for programmers. However, I also find some nonprogramming packages useful. For example, a programmer can use dBPlus to modify the structure of his data base files, even though it, strictly speaking, is not a pure programming aid.

The seven packages reviewed here are dBPlus (HumanSoft), dB/RA (Gryphon Microcomputer Products), dBRx (Gryphon), dSECUR (Microclear, Inc.), dUTIL (Fox & Geller), dCROSS (Radix 2 Software), and Extended dBASE II (Micro Business Systems). See table 1 for a summary of features and purchasing information for these packages. I was generally pleased with the overall quality of the programs, although several of them have notable defects. Obvious user errors are usually well trapped, with on-screen error messages that are easy to understand.

dBPlus is an interesting set of add-on commands. It will speed up the sorting of a dBASE II data base; it will compress dBASE II data base files; and finally, it will let the user modify data base structures with an easy, menu-driven procedure that will produce output files in either dBASE II or MailMerge format for use with MicroPro's WordStar word processing program. Except for some minor quirks, dBPlus does what it claims it will do.

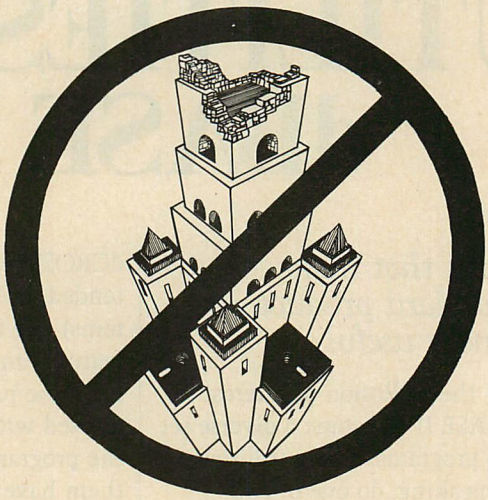
dB/RA is a neat little utility that allows the use of arrays as memory variables in dBASE II. This effectively extends the number of memory variables from the dBASE II limit of 64 to 65,535—more or less the same limit as the number of records in a dBASE II data base. I only wish this program had been around three years ago when I was trying to manage those 64 memory variables.

dBRx incorporates a lot of mathe-

Anthony K. Lima is president of Pacific System Design Workshop, Inc., which handles micro- and minicomputer-based management information and decision support systems. He also teaches in the Department of Economics at Stanford University.

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matical functions into dBASE II, including sine, cosine, arctangent, square root, logarithms (base 10 or base e), and exponentials.

dSECUR lets the user set up password protection for his dBASE II programs. The user can make certain programs accessible only to particular individuals by assigning their names and passwords to the particular program. Multiple assignments of user and program names are allowed.

dUTIL is probably the best known of these seven packages—largely because it was one of the first and certainly one of the most heavily advertised of such products. dUTIL significantly reduces the running time of many dBASE II programs. Especially if the main program calls other procedures, dUTIL will speed things up considerably. dUTIL helps maintain and debug programs and assists with documentation.

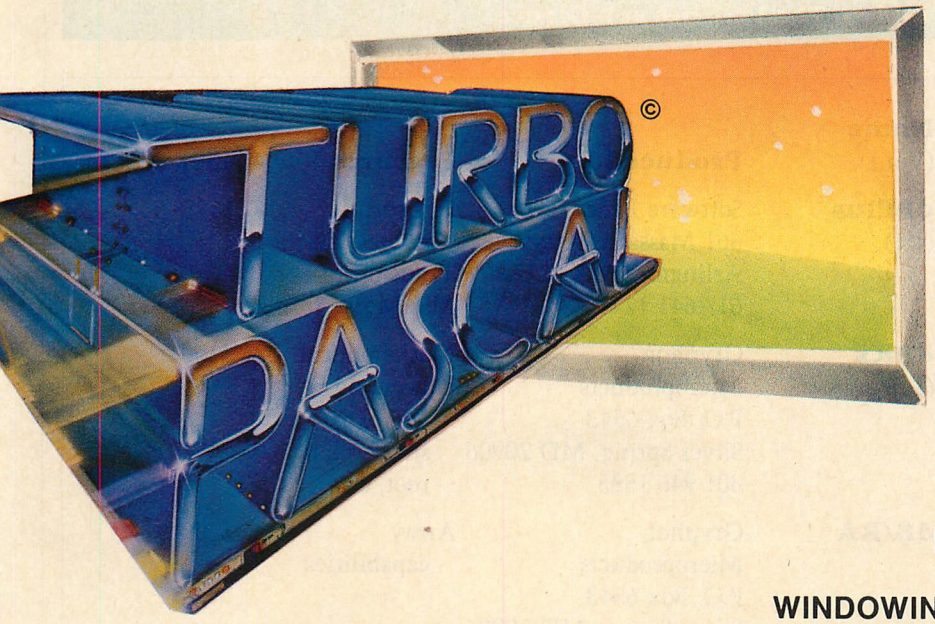
dCROSS is a utility that is designed for professional dBASE II programmers. It will produce a cross-reference listing of memory variables and other keywords in alphabetical order, showing the line number(s) on which each appears. It numbers the lines in the program, indents IF and DO WHILE structures, and checks to be sure that each IF is matched by an ENDIF, each DO by an ENDDO, and that apostrophes, quotes, and parentheses all have matches.

Extended dBASE II (E/dBASE II) claims to do three main things. First, it allows the user to reprogram the PC keys so that typing the reprogrammed key will send the programmed character string to dBASE II. This is a useful facility for repeated commands. Second, memory management is extended to the bit level; dBASE II currently gives access only to individual bytes via the PEEK and POKE functions. This bit-mapping feature comes with a full set of Boolean operators, significantly speeding up multiple index searches.

Third, E/dBASE II includes some extended character string functions. In particular, direct access to either

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Table 1: The Utilities at a Glance

Name (Ver.)	Produced By	Features	List Price
dBPlus (1.1)	Software Banc 661 Massachusetts Ave. Arlington, MA 02174 617-641-1241	Fast sorting Compression Transform MailMerge format	$125
dBRx (1.0)	Gryphon Microproducts P.O. Box 6543 Silver Spring, MD 20906 301-946-2585	Mathematical functions: log, exp, sine, square root, etc.	$150
dB/RA	Gryphon Microproducts P.O. Box 6543 Silver Spring, MD 20906 301-946-2585	Array capabilities	$200
dSECUR	Microclear, Inc. 342 Madison Ave. New York, NY 10017 212-867-0481	Password protection	$99
dUTIL (I1.2)	Fox & Geller 604 Market St. Elmwood Park, NJ 07407 201-794-8883	Keyword lists Combines program segments Makes program "pretty"	$99
dCROSS (1.6)	Radix 2 Software P.O. Box 1230 Loomis, CA 95650 916-652-6288	Cross-reference listings Checks for "matches"	$49
E/dBASE II (4.0)	Micro Business Systems 23 Overton Rd. East Windsor, NJ 08520 609-443-6125	Bit-mapping Extended functions Programming keyboard	$99.95

the farthest left or the farthest right word in a multi-word string is now available, which will make setting up mailing list programs easier.

Unfortunately, this program has only recently been released for the PC and still has some problems. Using DOS 2.0 and version 2.4 of dBASE II, for example, I was unable to reprogram the keyboard or use several of the functions. The most useful feature, bit-mapping, however, worked wondrously well. Micro Business Systems is aware of these problems and is working on them. I would recommend E/dBASE II on the strength of bit-mapping alone, but some users may be more interested in other features that the package offers.

Of these seven packages, I was most impressed with dB/RA, dBRx, dUTIL, and dCROSS. Each of these

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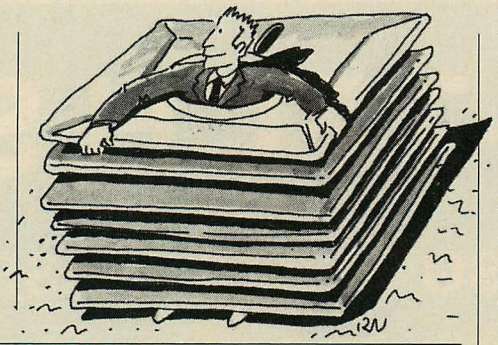
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does a limited number of things, but does them well. dBPlus worked well but had some minor bugs. dSECUR also worked well, but it was accompanied by some of the worst documentation I've ever read—it took me an hour just to get a simple password file set up. E/dBASE looks promising. However, if the user doesn't need bit-mapping, he may wish to wait until the debugged version is released.



Detailed discussions of these packages follow.

dBPLUS

dBPlus is an unusual combination of three functions: rapid sorting of dBASE II files, compressing of dBASE II files, and transforming of those files. In order to use dBPlus, the user must QUIT dBASE II and run dBPlus. This may be somewhat more of a hassle than it seems, as the dBPlus program files occupy 183,040 bytes of disk space. Fitting the system files, dBASE II, and dBPlus onto a single disk, with some room left for data, could be quite a trick, unless you're running quad density. Fortunately, dBPlus is written in a modular fashion: the user can copy only those parts of the program that he needs onto a single disk, leaving room for dBASE II and some data files.

dBPlus is completely menu-driven. Clear, easy to understand menus describe the various operations available and how to get to them. To select an operation, press the space bar to move forward to the next operation, press the "-" sign to move back one, or type the first letter of the desired operation. This last option lets the user bypass the cumbersome menu operations once he has become familiar with the program. Other software publishers could learn from this example—many people like menus when they are learning a program but would just as soon turn them off once they know how it works. To select a particular operation, just hit the Return key. A new menu will be presented, or the selected operation will begin.

One other nice thing about the dBPlus menus is that they try to anticipate what the user will want to do next. For example, when the SORT menu appears on the screen, the highlighted option is "SELECT INPUT FILE"—in other words, tell dBPlus which file to sort. This is normally the first thing a user would do

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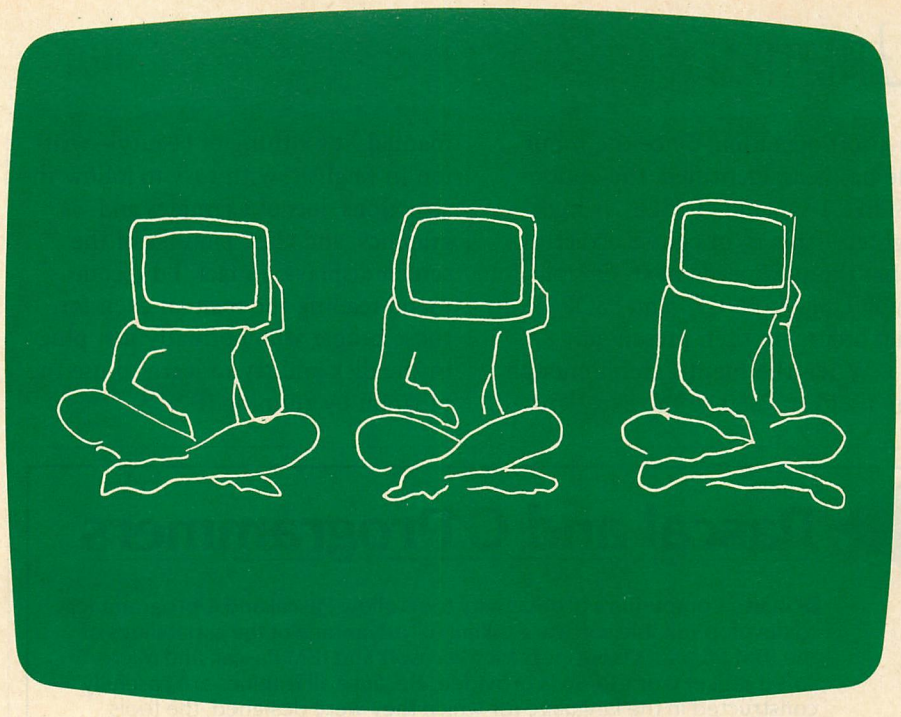
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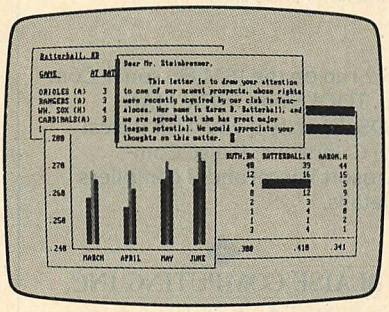
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in a sort operation. Once the input file has been identified, the option "SELECT OUTPUT FILE" is highlighted—this is, of course, exactly what the user needs next. Options for "SORT SEQUENCE" and "SORT", in that order, are then presented.

When the menus aren't enough, the user can refer to the excellent manual. It's a thing of beauty—written in English, with easy-to-follow instructions, lots of examples and graphics, and clear pictures of the screen displays. In fact, I'd recommend reading the manual even for those people who normally just plug in the disk and try to learn to use the program by running it.

dBPlus comes with a great guarantee. Along with the program disks, the purchaser gets a sealed envelope containing a secret code. Without this code, the user is restricted to files of no more than 100 records. If he doesn't like the program, he just returns it within 30 days with the seal on the envelope intact and he gets a full refund. Once the seal is broken, the user owns the program and can "unlock" the 100-record restriction.

The dBPlus SORT option is advertised as being much faster than a dBASE II sort—and the advertising seems to be true. I tested dBPlus and dBASE II in sorting a list of 1,000 random numbers. dBASE II took 6 minutes and 20 seconds to sort this file; dBPlus took 30 seconds, roughly a 13-fold improvement. As a second test, I sorted the sample file that came with the program, which consisted of a 50-record address file. The improvement was comparable to that in the first test. dBPlus really speeds up sorting.

That's the good news. The bad news is that the sort modules of dBPlus take up 48,384 bytes of disk space. dBASE II has been widely criticized for its slowness in sorting. Because the only way to fit dBASE II into 48K of memory is to use a relatively simple sorting algorithm, this slowness can be annoying. dBPlus exemplifies this problem. It can, indeed, sort things 13 times faster than dBASE II can. However, to do this, the user has to exit dBASE II, start dBPlus, get through the initial menu, and set up input and output files, as well as the sort sequence. Only after performing these actions can the user actually start to save time.

Large data bases that require regular sorting (or sorting on a complex combination of key fields) can use dBPlus to good advantage. For ordinary sorting problems, however, the user should probably try to figure out a way to use the INDEX command. After all, that's why dBASE II has such a low-level sort algorithm—most problems can be solved using INDEX, which is reasonably fast.

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One further word about the dBPlus sort: combinations of fields to be sorted can be specified, as can the sorting order (ascending or descending) of each field and the priority assigned to each field. For example, suppose the user wanted an address list sorted in descending order by zip code and, within each individual zip code, sorted in ascending order by the first letter of each last name. He would tell dBPlus that his data base was to use ZIP as the field with priority 1, and that ZIP was to be sorted in descending order (D). He would then specify that LAST:NAME was to be the field with priority 2, to be sorted in ascending order (A). The on-screen menu is not completely clear at this point; fortunately, the manual clarifies things quite nicely.

Although I did not test this claim, the manual says that as many as 32 fields can be sorted at once; however, only 10 different priority levels can be assigned. For most purposes, this means that "only" 10 fields can be sorted at once. Being able to sort that many fields will satisfy nearly every dBASE II user.

To summarize, SORT works quite well and seems to do pretty much what it says it will do. My only reservation is its treatment of fields generated outside dBASE II and then transferred into dBASE II format. However, this is a small criticism indeed—based on my experience with dBASE II, it's probably as likely to be a dBASE II bug as a dBPlus bug. One final note—data bases take up significantly less disk space after they have been run through the dBPlus SORT procedure, because dBPlus uses a 128-byte block size whereas dBASE II writes data bases in 512-byte blocks.

The next options will interest anyone who really wants to save space. COMPRESS and DECOMPRESS will squeeze a dBASE II data base into about 35 percent of the disk space that dBASE II uses. COMPRESS does the squeezing; DECOMPRESS restores the files to the original

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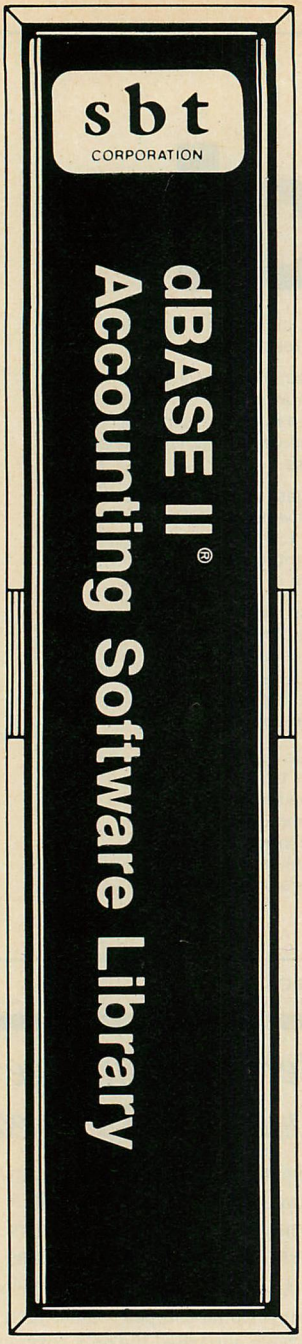
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dBASE II format. I can think of two uses for these functions. If a user regularly sends dBASE II files over a long-distance phone line, sending shorter files will take less time and cost less. In fact, the savings should be proportional to the degree of squeezing—in this case, the cost would be about 35 percent of the original. Of course, the person receiving the COMPRESSed data base must have dBPlus running on his machine so he can DECOMPRESS the data base once he has received it.

The second use of COMPRESS is for archival storage. Everyone knows the necessity for maintaining back-up copies of anything on floppy disks. The usual recommended number, in fact, is two backups. Anyone who has a lot of data also has a lot of money sunk into floppy disks. Run through dBPlus, material will take up only 35 percent of its original space, which means, roughly, that three floppy disks could be replaced with one. If I had a lot of dBASE II data files and had to maintain permanent copies of them, I'd buy dBPlus in a flash.

The COMPRESS feature is even easier to use than the others—all the user does is specify an input file name and an output file name.

The only problem I ran into was in trying to DECOMPRESS two (previously COMPRESSed) datafiles in a row. dBPlus crashed the operating system when I tried to DECOMPRESS the second data base. It did this so thoroughly that the system had to be cold-booted. HumanSoft knows about this problem and says it has been fixed in more recent versions of dBPlus. Purchasers should check this before they "unlock" the program. I got the impression that the problem has been fixed for CP/M versions of the program but may still exist for PC-DOS versions.

The final function is TRANSFORM. This function provides an easy, menu-driven way to modify the structure of a data base, while at the same time protecting against loss of data. It also permits the user to con-

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vert dBASE II data base files into MailMerge files for use with MicroPro's popular WordStar word processor. This means that converting from a dBASE II data base to a MailMerge file becomes simply a matter of selecting the fields, selecting a menu option, and hitting Return. I guess those of us who teach seminars on how to do this are out of business. Of course, we'll still have to explain how to produce mailing labels—dBPlus won't do that.

I suspect that most people who buy dBPlus will do so for either the fast sorting or the MailMerge file-conversion feature. In my tests, the MailMerge conversion performed smoothly and flawlessly. The other half of the TRANSFORM function, however, is of equal interest. To understand why, it is necessary to understand a little bit about dBASE II.

Suppose a user set up a data base in dBASE II and later decided that one of the fields was too "short": there weren't enough character spaces for the length of the data that was going to be entered. For example, in a mailing list, the user may have allowed only five spaces for the zip code, but now he wants to use the new nine-digit zip codes (which take ten spaces, including the hyphen). dBASE II requires the following sequence of commands:

```
.USE filename
.COPY STRUCTURE TO newfile
.USE newfile
.MODIFY STRUCTURE
  (make changes in structure)
CTRL-W
.USE newfile
.APPEND ALL FROM filename
  (check to make sure that the
  append really worked)
.DELETE FILE filename
.RENAME newfile TO filename
.USE filename
  (fix zip codes)
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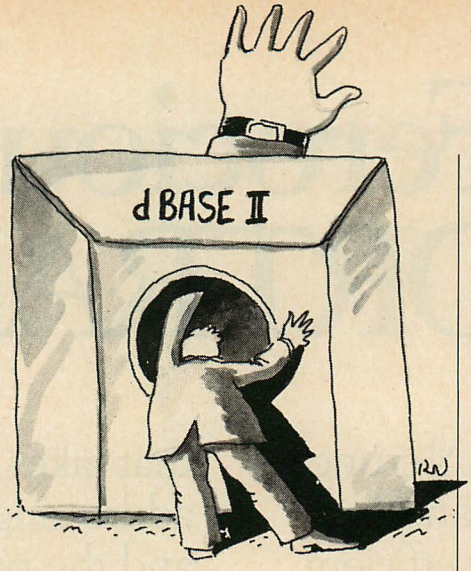


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for even experienced dBASE II users to forget a step in this procedure. Hopefully, they're experienced enough to have made a backup copy of their data before they began.

dBPlus automates this process in an easy, menu-driven fashion. It's difficult to make mistakes, and the process is a lot more pleasant than the nerve-wracking one required by dBASE II. The only problem is that the user has to quit dBASE II, run dBPlus (probably swapping disks as well), then get out of dBPlus and restart dBASE II. It's worth the trouble. As far as I could tell, the program will prevent most of the "idiot" mistakes that all of us make. Furthermore, it worked just fine.

I'd recommend dBPlus to anyone who thinks he needs any of its three major features. This recommendation is based on good documentation, an outstanding guarantee, the fact that backup copies can be made, and HumanSoft's helpful attitude.



dBRx AND dB/RA

dBRx and dB/RA are two of the most potentially useful programming tools I have encountered. Briefly, dBRx adds a number of mathematical functions to dBASE II, and dB/RA implements array structures. These array structures can be handy: they effectively increase the number of memory variables available from the dBASE II limit of 64 to the array size limit of 65,535. Programmers who sometimes use many memory variables and find themselves swearing every time the message "TOO MANY MEMORY VARIABLES" appears on the screen will appreciate dB/RA—it won't solve all their problems, but it will help. Unfortunately, the mechanism for moving data into and out of the arrays is clumsy, making the data in the arrays less accessible than it might otherwise be.

dBRx and dB/RA are among the easiest programs to get running that I've ever used. Each program installs "into" dBASE II, so the user doesn't have to exit to use them. dB/RA and dBRx are loaded into memory through a series of POKE commands that store machine language code into the dBASE II SORT work area. As might be expected, the dB/RA and dBRx commands must be reissued following each SORT.

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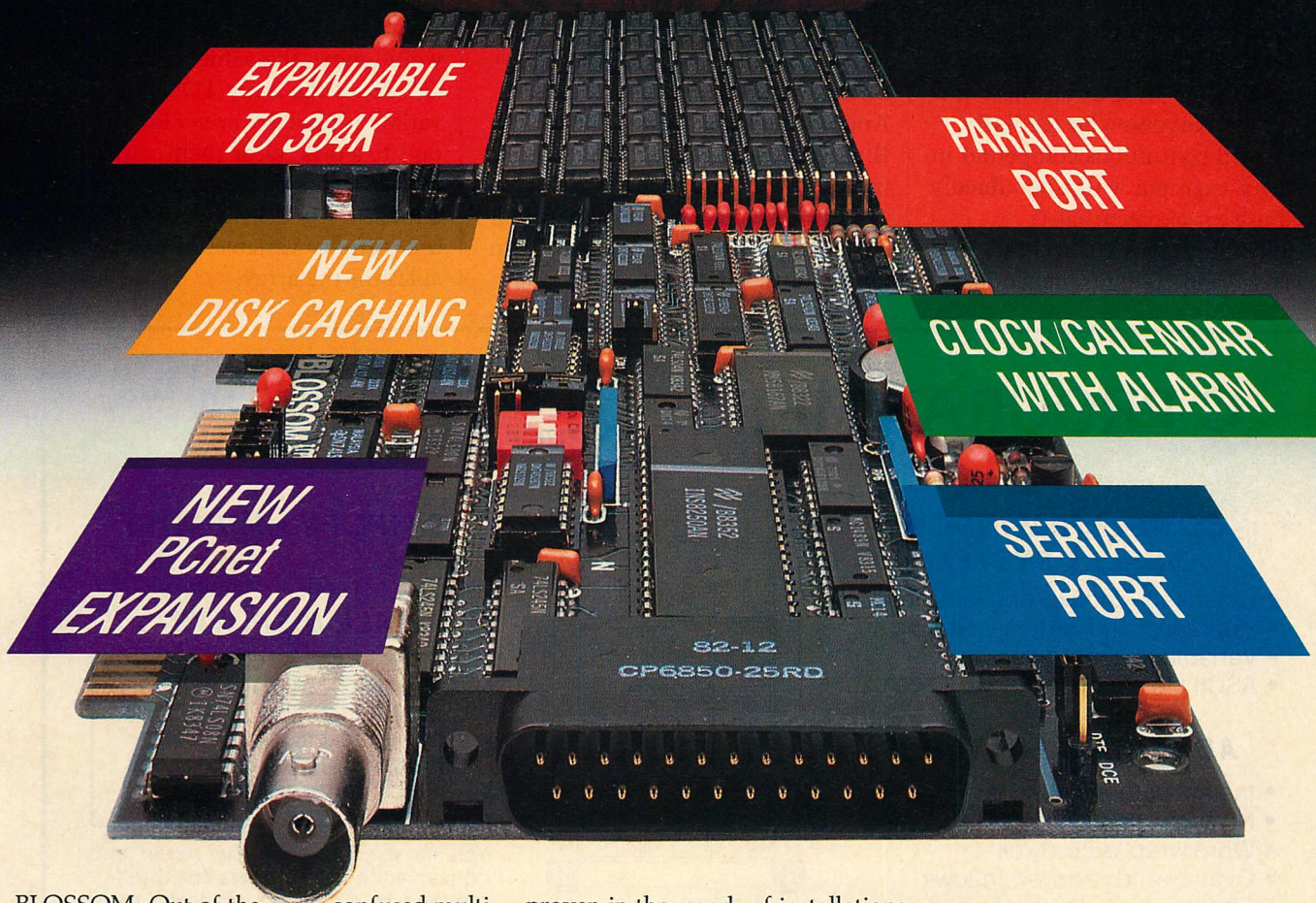
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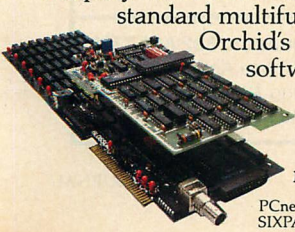
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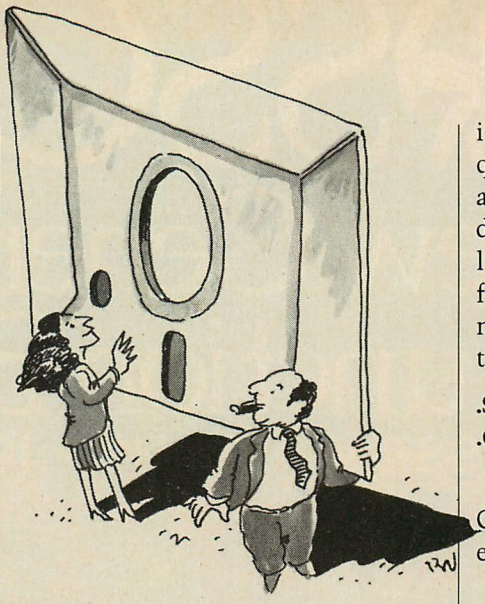
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All a user has to do to include the mathematical functions in the program set, for example, is to type DBASE DBRX. The available functions include logarithms (natural and base 10), exponential, sine, cosine, arctangent, and square root.

dBRx also includes three utility functions. PACK will condense any sequence of more than a single space down to one space. BTRIM will remove leading spaces from a string (as compared to the dBASE II TRIM function, which removes trailing spaces). Finally, NOSPACE removes all the spaces from a string.

The mathematical functions will probably be most useful to people in the fields of science and engineering, as well as some areas of business and economics. Anyone who regularly works with continuous compound interest, for example, will undoubtedly find a use for exponentials.

dBRx functions are accurate to between 7 and 10 digits, depending



on the function. I asked for the sine of 90° and got 1.0000000050. dBRx is fast—the function values were returned virtually instantaneously. And, for interested users, the dBASE II program code for each function is included with the package.

dB/RA is equally easy to install. Although some of the command syntax is a little obscure, the examples included with the program will quickly show a user how to use the array features. dB/RA uses the dBASE II CALL capability for virtually all its functions. For example, the following sequence creates an array named TONY that is 4x3x56 and initializes all its values to 0.00:

```
.STORE 0.00 TO M1
.CALL M1 DIMENSION TONY
  (4,3,56)
```

Character or logical, as well as numeric, variables can be used.

To get numbers out, dB/RA uses a similar sequence:

```
.CALL M2 LOAD TONY (3,2,23)
```

would move the value in location (3,2,23) of the array TONY to the variable M2. Users can also save arrays to a disk, clear them, display information about them (name, type, dimension, and space occupied), and use memory variables as index variables for the array.

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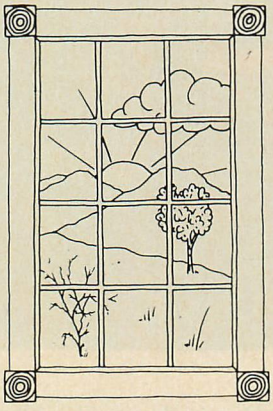
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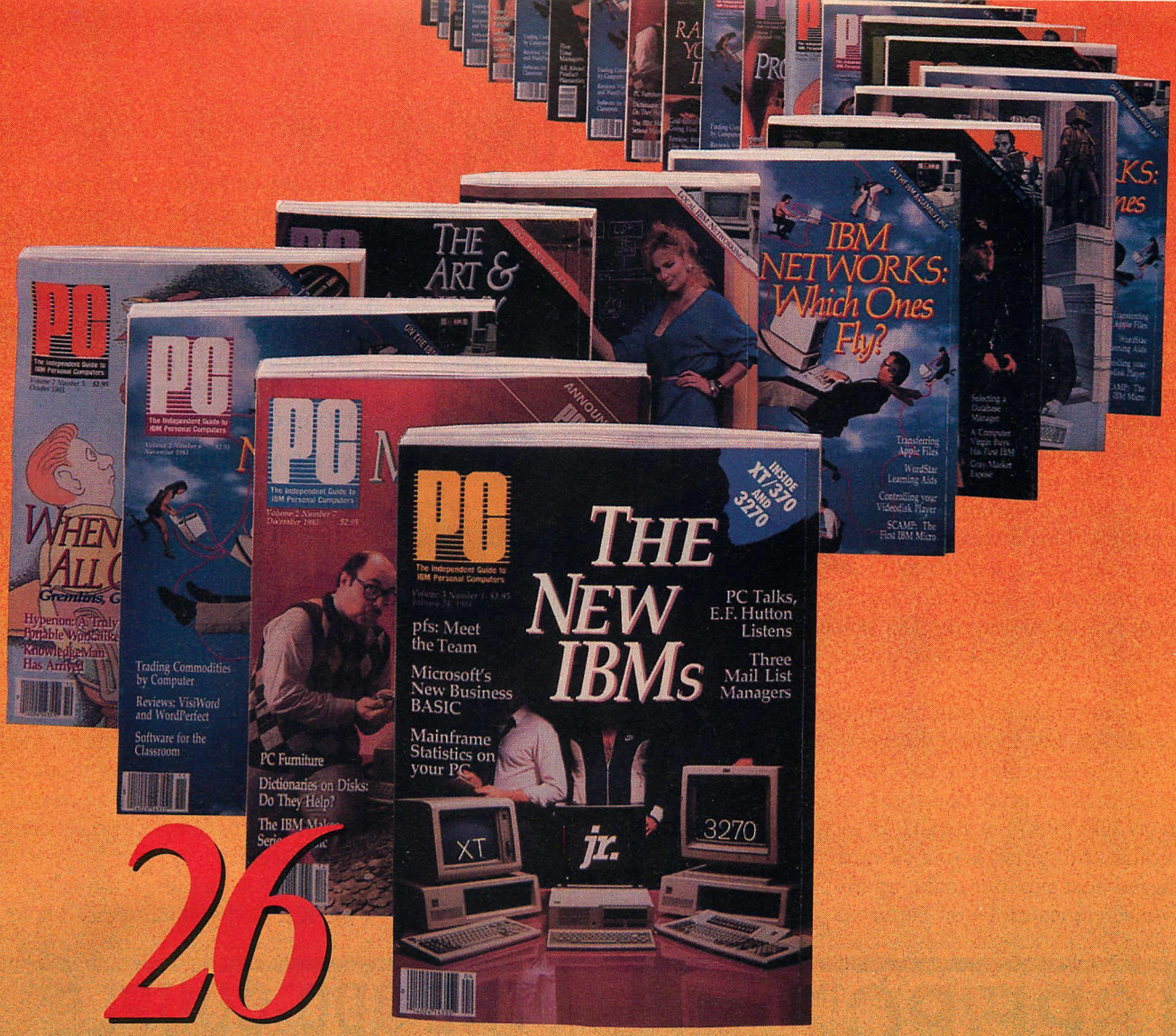
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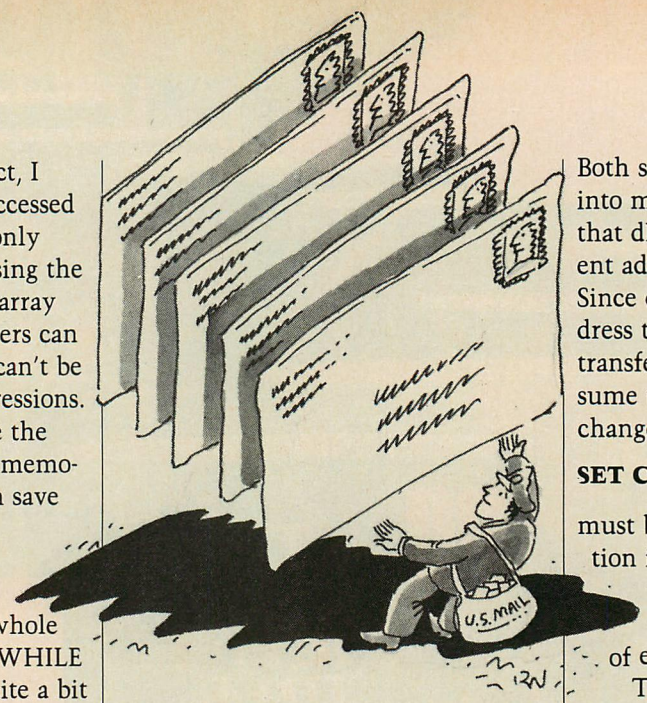
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dB/RA works well—in fact, I was impressed at how fast it accessed the test arrays I created. The only problem is the necessity for using the CALL command. Granted, an array containing up to 65,535 numbers can be set up. But those numbers can't be used directly in dBASE II expressions. Instead, the user must retrieve the desired number, load it into a memory variable, work with it, then save the result to his array (if he wants to). This involved process makes doing something like inverting a matrix not a whole lot of fun. Setting up the DO WHILE loops to do this would take quite a bit of time.

I can imagine a number of uses for dB/RA, but it won't do everything. For example, the package won't perform array operations as easily as FORTRAN or BASIC. In fact, because the syntax is so awkward, I suggest that the user make up his own reference card—or, better yet,



that Gryphon start supplying them.

To use dB/RA and dBRx together, bring up dBASE II with the command

DBASE DBRX

then issue the command

DO DB!RA

Both sets of functions are now loaded into memory. The only problem is that dB/RA and dBRx require different addresses for the CALL statement. Since dBRx functions change the address to which CALL statements are transferred and dB/RA functions assume the address is preset and unchanged, the command

SET CALL TO 58233

must be issued after each dBRx function in order to use dB/RA. One easy way to do this is to add the SET CALL TO command to the end of each of the dBRx command files.

The documentation is better than average. There are short manuals shipped with the disk, and each disk contains a file labeled READ-ME. Just print out this file to get started. I had no trouble following the simple instructions for installation.

dB/RA includes a file called QUICKTUT (which stands for

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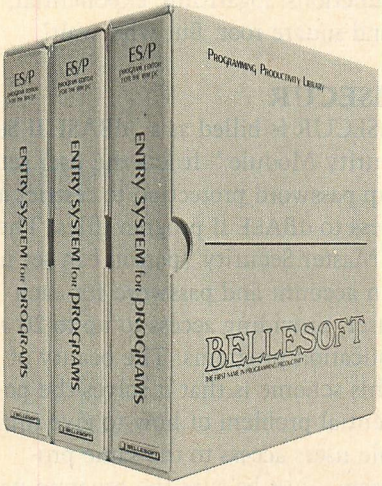
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"quick tutorial" and has nothing at all to do with ancient Egyptian kings). After installing dB/RA, follow the examples in QUICKTUT to learn the essentials about dB/RA. dBRx includes a file called HELP.PRG. Type DO HELP after entering dBASE II for a listing of this file. For a printed listing, always remember to SET PRINT ON before proceeding.

I found dBRx and dB/RA to be two of the easiest and most useful utilities I've ever encountered for dBASE II. As far as I could tell, there are no bugs in the programs, and common errors seem to be well trapped. For example, my attempt to take the logarithm of zero produced an error message to the effect that doing so was impossible.

For users who need either mathematical functions or arrays in dBASE II, I strongly recommend these two products. I should mention that version 2.6 of dBASE II (as currently planned) will include three of dBRx's functions: logarithm, exponential, and square root. But why wait?

dSECUR

dSECUR is billed as a "dBASE II Security Module." It lets the user set up password protection to restrict access to dBASE II program files. The "Master Security" person can set up an account and password for each user, providing access to up to 20 application programs. The beauty of this scheme is that it solves the potential problem of how to give multiple users access to the same program—just be sure the program name is in the access list for each user.

dSECUR works reasonably well. It has two drawbacks, however. First, it is slow. If you think dBASE II programs are slow now, wait until you see them run under dSECUR. Even the copyright notice lasts for what seems like forever—and it comes up every time the program is run. (To eliminate this, change the counter on the DO WHILE loop in the program file dSECUR.PRG from 200 to a more reasonable number—like zero.)

The second problem is that the manual is an embarrassment. I thought that by now the computer industry had learned the importance of good documentation. Apparently (and sadly), I was mistaken. The manual begins by failing to tell you to make a backup copy of the original diskette. Take my advice and do this first. The manual contains so many mistakes that it took me nearly two hours to get dSECUR running in a reasonable fashion. I would hate to be a relative novice trying to figure it out. The program does work, and, in fact, works pretty well, but learning how to use it can be frustrating.

Perhaps Microclear, Inc. just took its lead from the original dBASE II manual, which was certainly not particularly helpful, either. In any case, it appears that the manual was originally written in some foreign lan-

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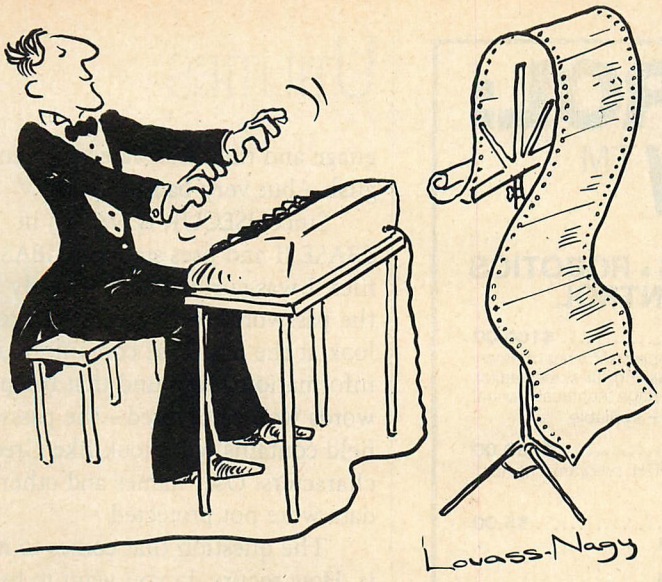
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guage and then translated into English—but very badly.

Since dSECUR is written in dBASE II and uses standard dBASE II files, I was curious to see exactly how the passwords were protected. I took a look at the data base containing user information and found that the passwords were encrypted—the password field contains what look like Greek characters. User names and other data were not protected.

The question that comes to mind is, How secure do you want to be? It appears possible for some imaginative user to take a look at the dSECUR program files and figure out the encryption scheme. An even easier technique would be for a user to buy a copy of dSECUR and become the Master Security person. Ultimately, security of this type must rely on either lack of knowledge on the part of the users or lack of curiosity. I suggest that dSECUR not be used to provide any serious security for a system—it just can't do that. dSECUR reminds me of the well-known operating system that provides each user with a password and separate file directory—and then allows any user to move from one user area to another by simply typing USER nn, where nn is some other user's number.

I have one other minor complaint: the program manual is bound in a flimsy plastic binder that generates a healthy amount of static electricity, which is not terrific for the floppy disks being shipped with them. I'd suggest that Microclear and other producers start to think about this problem. Of the dozen or so floppy disks I looked at in writing this review, one was unreadable. I don't think it's a coincidence that it was wrapped in a cellophane package.

dUTIL

dBASE II programmers who regularly write large dBASE II programs that call numerous other procedures will find that dUTIL can help, both with the documentation and with speeding up execution.

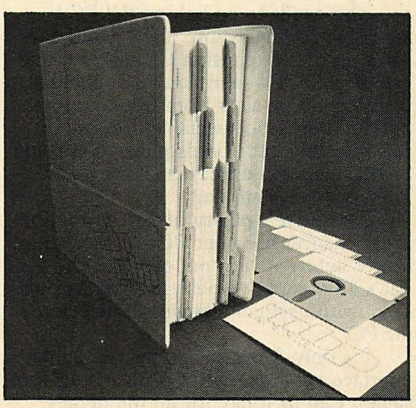
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UTILITIES

We all learn that we should produce "pretty" programs. Program statements contained within DO and IF commands should be indented, so that it's easy to figure out where the loops begin and end. ENDDO and ENDIF statements should give some clue as to which DO and IF they match. Major program segments should be identified. Many of us also manage to regularly ignore these rules, perhaps thinking, "I'll go back and make the program look nice once it's working." Most of us never do, and our programs show it.

dUTIL can save us from ourselves. It automatically indents and identifies DO and IF loops; it produces a "map" of the tree structure of the programs; it creates a BATCH file that automatically either copies program files or prints them; it puts all variables in lower-case type, keeping keywords in upper-case—and the keyword list can be changed. In short, dUTIL makes a sloppy program look pretty. In fact, the default output file name is PRETTY.NEW. And all this costs a mere $99.

In order to understand how dUTIL speeds up program execution, it is necessary to understand how dBASE II runs programs. dBASE II reads program files from disk one at a time. This means that every time one procedure calls another, dBASE II reads the newly called procedure from disk, which slows down the program's execution immensely.

dUTIL solves this problem by combining all the separate program files into one large file, placing the code for each called program at the point at which it was called. The user can specify the files to be included or just let dUTIL pick them by looking for DO commands. Although crude, this technique is remarkably effective—in my tests, execution time of a series of programs requiring considerable disk retrieval was improved by a factor of two.

The test programs I used are shown in listings 1 through 5. TEST1 calls TEST2 and TEST3 repeatedly, depending on whether certain conditions are met. TEST3 calls TEST4 as well. Finally, TEST1 calls TEST5. The programs were deliberately designed to include a large number of disk accesses—probably more than there would be in a typical program. I wanted to see how much dUTIL could speed up execution.

The results were amazing. The dUTIL-ized version of the program took 4 minutes, 10 seconds to run. The plain dBASE II version took 9 minutes, 30 seconds. It looks like dUTIL can cut running time by over 50 percent. Impressive results, considering that the program produces nice-looking code in addition.

Listing 6 shows what the programs looked like after a run through dUTIL. Note that all the RETURN statements are converted into comment lines—including the last one. I ran the program in listing 6 just to see how dBASE II would respond to there being no Return at the end, and the program worked just fine. Figure 1 shows the "tree" structure produced by dUTIL. Anyone working with a really large-scale series of programs would find this feature helpful for getting documentation together.

Figure 1:
The dUTIL Tree Structure

```
0       TEST1
1            test2
1            test3
2                 test4
1            test5
```

The manual for dUTIL is short and to the point. Fox & Geller knows that this program is not written for the average dBASE II user, and the style of the manual reflects this. Anyone who doesn't have a good knowledge of dBASE II programming shouldn't buy dUTIL.

There is one disturbing thing: the Fox & Geller licensing agreement restricts use of dUTIL to a single CPU. This is great if the user only programs on his own computer. However, if he is in the contract program-

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ming business, a multiple-CPU license would be nice. Contract programmers usually use the client's computer to write their programs. It seems to me that requiring each client to buy dUTIL just so the programmer can get his work done faster is asking a bit much.

dCROSS

dCROSS is another useful, well-designed utility. It has one feature in common with dUTIL—both programs produce neatly indented IF and DO structures. I think that dUTIL produces prettier programs, because it also capitalizes only those words contained on the keyword list and because it combines multiple procedures into a single program.

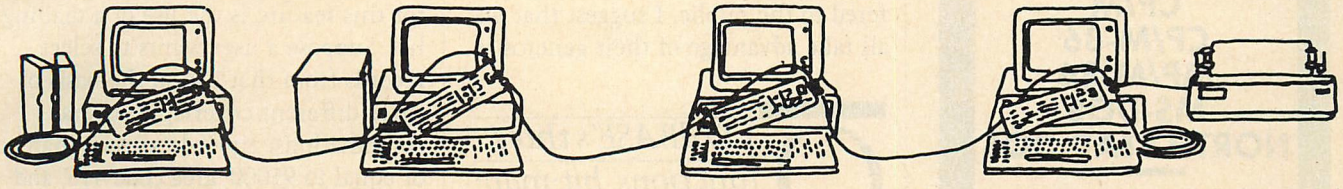
I'd argue, however, that the professional programmer really ought to own both these packages. dCROSS will also produce cross-reference listings of memory variables keyed to a listing of a dBASE II program file that includes line numbers. In addition, it will produce similar listings of dBASE II keywords with line numbers. Last (but hardly least), dCROSS will check a file for matches.

There are several commands in dBASE II that require matching structures. The two most obvious commands are DO WHILE . . . ENDDO and IF . . . ELSE . . . ENDIF. DO CASE . . . ENDCASE is another. dCross also checks for other less obvious (but more common) omissions. Quotation marks (" "), apostrophes (' '), and brackets ([ ]) must often match. Everyone who has programmed in dBASE II has left out the second quotation mark or apostrophe at least once.

dCROSS produces nicely indented program code. As a matter of curiosity, I ran the program in listing 6 through dCROSS. The indentations produced by dUTIL were left unchanged; I got a nice cross-reference listing of memory variables and keywords (figure 2). Further, dCROSS trapped my attempts to omit ENDDO, ENDIF, and other syntax requir-

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Menu driven	Yes	No	Yes	Yes	Yes
Files open on line	8	2	N/A	2	1
Maximum records/file	100,000,000	65,600	32,800	32,800	32,800
Maximum bytes/record	10,000	1,000	2,400	1,000	255
User must be programmer	No	Yes	No	No	No
Maximum number of indexes automatically updated.	15	1	1	1	1

(Data are taken from most recent versions of programs available to American Planning Corporation, Alexandria, VA)

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ing matching. Figure 3 shows the results of a test of this feature.

Like dUTIL's manual, dCROSS's is short and to the point. Indeed, dCROSS was developed by Radix 2 Software for the company's internal use and has only recently been offered to the public. I suggest that we all take advantage of their generosity.

Of E/dBASE's three functions, bit-mapping is the most important. This feature alone may make E/dBASE II worth purchasing.

EXTENDED dBASE II

E/dBASE II is another package that installs into dBASE II. By typing EDBASE, the user incorporates the E/dBASE II features and commands into the dBASE II command set, so they are available for use without exiting dBASE II.

E/dBASE II offers another unusual combination of features. According to its claims, the package allows the user to reprogram the entire keyboard, add certain functions to dBASE II, and permit bit-mapping of data bases. Of these three functions, bit-mapping is the most important. It is also the only one that worked to my satisfaction. Nevertheless, this feature alone may make E/dBASE II worth purchasing.

Bit-mapping is, to a certain extent, a substitute for the SORT and INDEX features of dBASE II. By creating a bit map of a data base, the user can select those records meeting certain criteria. Assume that the data base contains 1000 records. The bit maps each will then be 1000 bits long, or 125 bytes each. For each record that meets the criteria, the bit corresponding positionally in the bit map to the record number will be set to "1." All other bits will be set to "0." E/dBASE II provides functions for combining bit maps to create bit maps that reflect a combination of criteria. The Boolean operator set includes logical AND, NOT, OR, and exclusive OR. This last operator can be especially useful, as it is not provided by dBASE II.

One example of an application for this feature is the use of a mailing list. Suppose a user wants to select records from that list on the basis of three different criteria, in several combinations: zip code greater than or equal to 95000, area code 415, and state CA. In E/dBASE II, he would create three bit maps, one for each selection criterion. For example, ZIPMAP would have bits set to "1" corresponding to records with zip codes greater than or equal to 95000 and a "0" otherwise. He could then use the Boolean operators to combine the three bit maps into another bit map that can be used to print the records that meet the combination of criteria.

This procedure is not the easiest to use. The bit maps must be recreated whenever the data changes. Bit-mapping is most likely to be useful to people who have large data bases and who routinely work with multiple combinations of variables. I'd have no hesitation recommending E/dBASE II to such people. Once the bit maps are set up, they are every "bit" as fast as would be expected.

The second feature of E/dBASE II is enhanced character-string manipulations. Two functions with obvious uses are the right-word and left-word functions, which extract the rightmost or leftmost word in a string. With these functions, the user will no longer have to set up separate fields for first and last name in mailing lists. The MID function replaces part of a character string with another string starting at a specified position. Both of these functions can be done in dBASE II, but the programming gets a little tricky, and having to do this repeatedly can get tiresome.

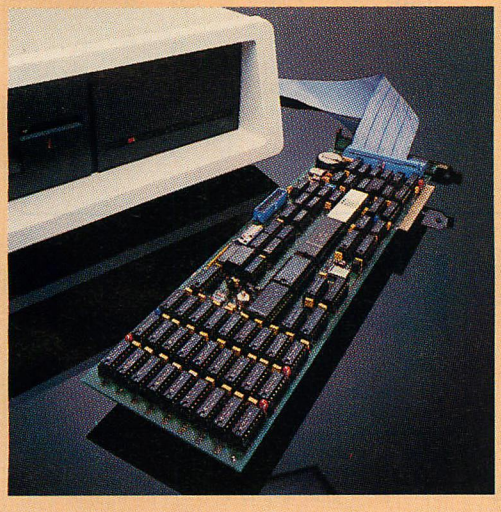
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changed, or the cursor can be eliminated completely. Windows can be created within which text can be scrolled continuously in several directions. A function is included to return the row and column number of the cursor. However, this function did not work under DOS 2.0 and version 2.4 of dBASE II.

The central problem with E/dBASE II is that it has been inadequately tested. Three different versions of the program are included in the system, corresponding to combinations of DOS 1.1 or 2.0 and dBASE II 2.3B or 2.4. Unfortunately, one entire set of E/dBASE II functions—those that allow the user to reprogram the keyboard to issue entire character strings in response to a single keystroke—will simply not work under DOS 2.0 and dBASE 2.4. Conversations with Micro Business Systems convinced me that the problem lies in the revisions Ashton-Tate made to produce version 2.4 of dBASE II. Micro Business Systems is aware of the problem and is working on it. To be sure that this feature will work in a particular situation, test E/dBASE II on a PC with DOS and dBASE II versions that correspond exactly to those you will use.

E/dBASE II's manual is not very well written but includes enough examples that the experienced dBASE II programmer can figure out how to use the features. I had no trouble installing E/dBASE II or using it, once I ignored the text and began working through the examples. The manual is packaged in another of those flimsy plastic binders—producing more static electricity to ruin disks.

Users who think they'll need bitmapping might well want to buy E/dBASE II. It works well and will speed up operations immensely.

CONCLUSION

The seven packages reviewed here vary widely, both in the features they offer and in the quality of those features. I was impressed by some of the guarantees being offered and the range of enhancements to dBASE II that can be found. In general, there is a large enough number of packages out there that it's worth looking around for a utility that might help solve some problem, no matter how unusual the application might be.

Figure 2: Listing 6, after Being Run through dCROSS

```
 1:  **********************
 2:  * program test1.prg *
 3:  **********************
 4:  ERASE
 5:  CLEAR
 6:  SET talk OFF
 7:  STORE 1 TO n1
 8:  STORE 1 TO m1
 9:  DO WHILE n1<100
10:    STORE n1+1 TO n1
11:    IF n1>50
12:      ** -- DO test2 -- ****
13:
14:      **********************
15:      * program test2.prg *
16:      **********************
17:      ERASE
18:      @ 5,20 SAY "This is N1"
19:      @ 6,25 SAY n1 PICTURE '999'
20:      STORE 1 TO n2
21:      DO WHILE n2<50
22:        STORE n2+1 TO n2
23:      ENDDO WHILE n2<50
24:      *       RETURN
25:    ENDIF n1>50
26:    DO WHILE m1<100
27:      STORE m1+1 TO m1
28:      IF n1<25
29:        ** -- DO test3 -- ****
30:
31:        **********************
32:        * program test3.prg *
33:        **********************
34:        ERASE
35:        @ 5,20 SAY "Now, here's TEST3 . . ."
36:        STORE 1 TO n3
37:        DO WHILE n3<50
38:          STORE n3+1 TO n3
39:        ENDDO WHILE n3<50
40:        ** -- DO test4 -- ****
41:
42:        **********************
43:        * program test4.prg *
44:        **********************
45:        ERASE
46:        @ 5,20 SAY "And this is TEST4 . . ."
47:        STORE 1 TO n4
48:        DO WHILE n4<50
49:          STORE n4+1 TO n4
50:        ENDDO WHILE n4<50
51:        *           RETURN
52:        *           RETURN
53:      ENDIF n1<25
54:    ENDDO WHILE m1<100
55:  ENDDO WHILE n1<100
56:  ** -- DO test5 -- ****
57:
58:  **********************
59:  * program test5.prg *
60:  **********************
61:  ERASE
62:  @ 5,20 SAY "Just plain TEST5 . . ."
63:  STORE 1 TO n5
64:  DO WHILE n5<50
65:    STORE n5+1 TO n5
66:  ENDDO WHILE n5<50
67:  * RETURN
68:  CLEAR
69:  RETURN
70:

Symbol table for cross-reference

*"CLEAR"          5    68
*"DO"             9    21    26    37    48    64
*"ENDDO"         23    39    50    54    55    66
*"ENDIF"         25    53
*"ERASE"          4    17    34    45    61
*"IF"            11    28
 "M1"             8    26    27
 "N1"             7     9    10    11    19    28
 "N2"            20    21    22
 "N3"            36    37    38
 "N4"            47    48    49
 "N5"            63    64    65
*"OFF"            6
*"PICTURE"       19
*"RETURN"        69
*"SAY"           18    19    35    46    62
*"SET"            6
*"STORE"          7     8    10    20    22    27
                 36    38    47    49    63    65
*"TALK"           6
*"TO"             7     8    10    20    22    27
                 36    38    47    49    63    65
*"WHILE"          9    21    26    37    48    64
```

Figure 3: How dCROSS Shows Missing Matches

```
     1:  ERASE
     2:  CLEAR
     3:  @ 5,1 SAY "GHASTLY
*******  String not enclosed by proper delimiters
     4:  STORE 1 TO N
     5:  DO WHILE N<50
     6:    STORE N+1 TO N
     7:    IF N<25
     8:    ELSE
     9:      RETURN
    10:
*******  IF without matching ENDIF
*******  DO WHILE without matching ENDDO


Symbol table for cross-reference

 "N"              4     5     6     7
```

ABSTAT: Statistics for dBASE II

Good, easy-to-use statistical software for microcomputers is hard to find. To accomplish statistical tasks it has usually been necessary to have access to a mainframe, either in person or via modem. ABSTAT is a software package that minimizes the mainframe requirement, allowing the user to perform most statistical testing and modeling procedures from his microcomputer room.

Unfortunately, ABSTAT is plagued by the same problems that have haunted other producers of statistical packages: limitations on the size of the data set and a relatively limited set of statistical tests. A maximum of 64 variables can be used at one time, with a maximum of about 4,080 data points (defined as the number of variables times the number of observations). Despite these limitations, many users will find ABSTAT a valuable package. It's easy to use (even without the manual) and runs relatively quickly.

ABSTAT is only loosely a true dBASE II add-on. It can read dBASE II data base files (.DBF files); it can also read ASCII files, as well as its own data file structure (.DDF). ABSTAT is divided into five major modules: data set commands, report commands, statistical commands, graphs, and miscellaneous commands.

Table 1 lists the statistical procedures that ABSTAT can perform. I tested these statistical capabilities with a data set of 1,000 pairs of observations. In general, I thought the program performed with admirable speed. A simple regression (including capturing the residual and calculation of the Durbin-Watson statistic) took about 3 minutes. Furthermore, Anderson-Bell claims that PCs with an 8087 mathematical co-processor will run about seven times faster. I can easily believe that; the 8087 would be a worthwhile investment for anyone who plans on doing a lot of statistics. The other functions performed up to my expectations.

It surprised me was how easy ABSTAT is to use. At virtually any point, typing a "?" will bring a help screen appropriate to the command or subcommand being used. If the user gets in trouble, he can usually abort the procedure by typing "!." I did note that a Ctrl-C usually booted me back into DOS, so users should be careful there. Other errors seem well trapped, however.

After a while, I stopped using the manual entirely and just relied on the help screens to work my way through. This was not because the manual was unhelpful—indeed, I found it comprehensive and lucid. However, it is bound with a glued binding and must be held open to the desired page, which is annoying.

Another problem is that those help screens take up disk space. I was unable to fit DOS and ABSTAT on a single disk. The ABSTAT files take up about 340K, leaving no room for much of anything else. Fortunately, ABSTAT is modular in structure, so some files can be omitted.

The report commands basically let the user dump output to a printer. A data and a 64-character title can be included with the output, as can the names of text files for placement within the report. This seems to me the wrong way to go about report writing. I would much rather have a write-to-disk option for the output from my statistical procedures. I could then pick up that file for use with my word processor. Using the commands provided by ABSTAT for report writing is unnecessarily restrictive.

The same is true of the two graph commands. These produce either a bar graph for specified variables or a scatter plot for a pair of variables. These graphs use no particular graphics characters and could be easily dumped to a disk file for use with a word processor.

The final major set of commands consists of the data set commands. These let the user create (or read in) data, edit it, generate a data set of random numbers, save the current data set, select certain observations (or groups of observations), sort data, and transform data using mathematical functions. The functions included are natural log, exponential, square, square root, sine, cosine, arctangent, and absolute value. In addition, the value of the mean and standard deviation can be used as constants in other expressions. The data set commands are more complete and easier to use than some mainframe statistical packages.

The final set of commands is called "miscellaneous." One command allows the user to write ABSTAT "programs" in the form of a file to be submitted to ABSTAT. If a lot of data must be processed in a variety of ways, having access to this batch mode will be quite helpful. A file directory command is available, but only for CP/M-80 versions, unfortunately. The only other command is INSTALL, which is used to tell ABSTAT what files are placed on which disk drives. This command is necessary only for splitting the ABSTAT files. Removing unneeded sets of commands from the disk will cause no problems; ABSTAT will just ignore the fact that those files are not present on your current disk.

Considering that ABSTAT is meant to be a set of relatively elementary statistical procedures, the functions it includes seem reasonable. It might be nice to have "add-on" extensions for various specialized fields. I would like to see some form of instrumental variables regression implemented, for example, but this is a personal preference. I'd also recommend the 8087 co-processor for working with more than about 1,000 data points. Otherwise, you may go crazy waiting for results.

Table 1: Statistical Functions of ABSTAT

Analysis of variance (either one-way or two-way)
Chi-square test
Correlation matrices
Descriptive statistics (including mean, standard deviation, variance, standard error of mean, coefficient of variation, median, mode, minimum, maximum, range, skew, and kurtosis)
Frequency distributions and "Z" scores
Mann-Whitney U Test
T-tests against population means (with either known or unknown population variance)
T-tests for the difference between the means of two variables
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Spearman rank correlation
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Listing 1 TEST1.PRG

```
**********************
* Program TEST1.PRG *
**********************
ERASE
CLEAR
SET TALK OFF
STORE 1 TO N1
STORE 1 TO M1
DO WHILE N1<100
STORE N1+1 TO N1
IF N1>50
DO TEST2
ENDIF
DO WHILE M1<100
STORE M1+1 TO M1
IF N1<25
DO TEST3
ENDIF
ENDDO
ENDDO
DO TEST5
CLEAR
RETURN
```

Listing 2 TEST2.PRG

```
**********************
* Program TEST2.PRG *
**********************
ERASE
@ 5,20 SAY "This is N1"
@ 6,25 SAY N1 PICTURE '999'
STORE 1 TO N2
DO WHILE N2<50
STORE N2+1 TO N2
ENDDO
RETURN
```

Listing 3 TEST3.PRG

```
**********************
* Program TEST3.PRG *
**********************
ERASE
@ 5,20 SAY "Now, here's TEST3 . . ."
STORE 1 TO N3
DO WHILE N3<50
STORE N3+1 TO N3
ENDDO
DO TEST4
RETURN
```

Listing 4 TEST4.PRG

```
**********************
* Program TEST4.PRG *
**********************
ERASE
@ 5,20 SAY "And this is TEST4 . . ."
STORE 1 TO N4
DO WHILE N4<50
STORE N4+1 TO N4
ENDDO
RETURN
```

Listing 5 TEST5.PRG

```
**********************
* Program TEST5.PRG *
**********************
ERASE
@ 5,20 SAY "Just plain TEST5 . . ."
STORE 1 TO N5
DO WHILE N5<50
STORE N5+1 TO N5
ENDDO
RETURN
```

Listing 6 Programs in Listings 1 Through 5, Merged with dUTIL

```
**********************
* program test1.prg *
**********************
ERASE
CLEAR
SET talk OFF
STORE 1 TO n1
STORE 1 TO m1
DO WHILE n1<100
    STORE n1+1 TO n1
    IF n1>50
        ** -- DO test2 -- ****

        **********************
        * program test2.prg *
        **********************
        ERASE
        @ 5,20 SAY "This is N1"
        @ 6,25 SAY n1 PICTURE '999'
        STORE 1 TO n2
        DO WHILE n2<50
            STORE n2+1 TO n2
        ENDDO WHILE n2<50
        * * RETURN
    ENDIF n1>50
    DO WHILE m1<100
        STORE m1+1 TO m1
        IF n1<25
            ** -- DO test3 -- ****

            **********************
            * program test3.prg *
            **********************
            ERASE
            @ 5,20 SAY "Now, here's TEST3 . . ."
            STORE 1 TO n3
            DO WHILE n3<50
                STORE n3+1 TO n3
            ENDDO WHILE n3<50
            ** -- DO test4 -- ****

            **********************
            * program test4.prg *
            **********************
            ERASE
            @ 5,20 SAY "And this is TEST4 . . ."
            STORE 1 TO n4
            DO WHILE n4<50
                STORE n4+1 TO n4
            ENDDO WHILE n4<50
            * * RETURN
            * * RETURN
        ENDIF n1<25
    ENDDO WHILE m1<100
    ENDDO WHILE n1<100
    ** -- DO test5 -- ****

    **********************
    * program test5.prg *
    **********************
    ERASE
    @ 5,20 SAY "Just plain TEST5 . . ."
    STORE 1 TO n5
    DO WHILE n5<50
        STORE n5+1 TO n5
    ENDDO WHILE n5<50
    * * RETURN
    CLEAR
    * * RETURN
```



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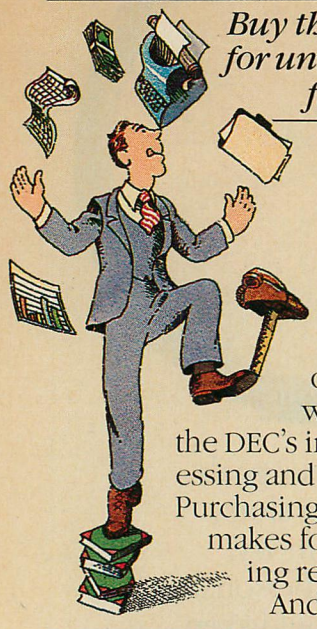
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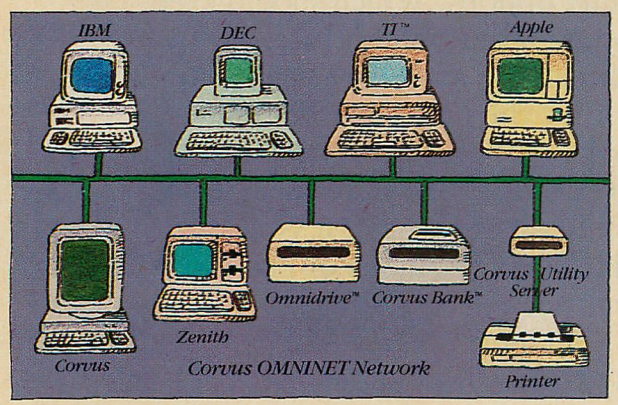


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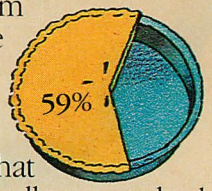
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CIRCLE NO. 160 ON READER SERVICE CARD

dGRAPH

STEVE JOHNSON
AND BOB KEPHART

The Plot Thickens

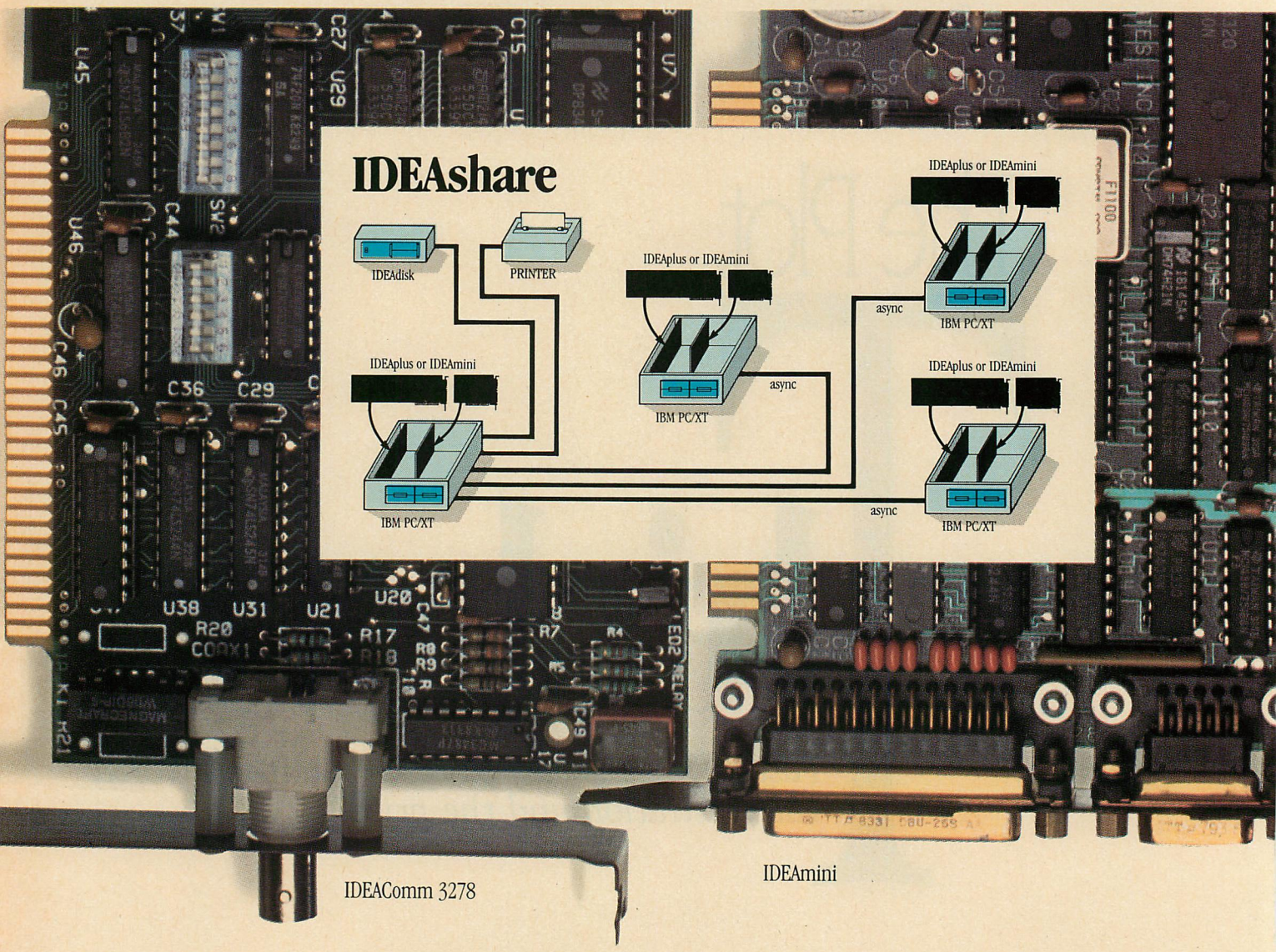
Fast but not-so-easy graphs—are they worth the frustration and the price?

Every good businessman or teacher knows that pictures are almost always more interesting than lists of data. Information that might otherwise be boring and dry can often be presented dramatically through such means as graphs and charts. Because creating graphs can be a time-consuming, frustrating task when done by hand, many people are looking to software packages, such as Fox and Geller's dGRAPH, to help them liven their presentations.

We have both good and bad things to say about dGRAPH. First, the good: dGRAPH is capable of producing quality graphs in a short period of time, and it is easy to use and easy to learn. Next, the bad: for a product that has been on the market (in one form or another) as long as dGRAPH has, it is dismaying that virtually nothing in the user interface and documentation can be complimented. The menus, file handling, prompts, and error messages are erratic and inconsistent.

Steve Johnson and Bob Kephart are senior consultants with Smith and Smith Associates, a software contracting corporation.

THE WORD IS



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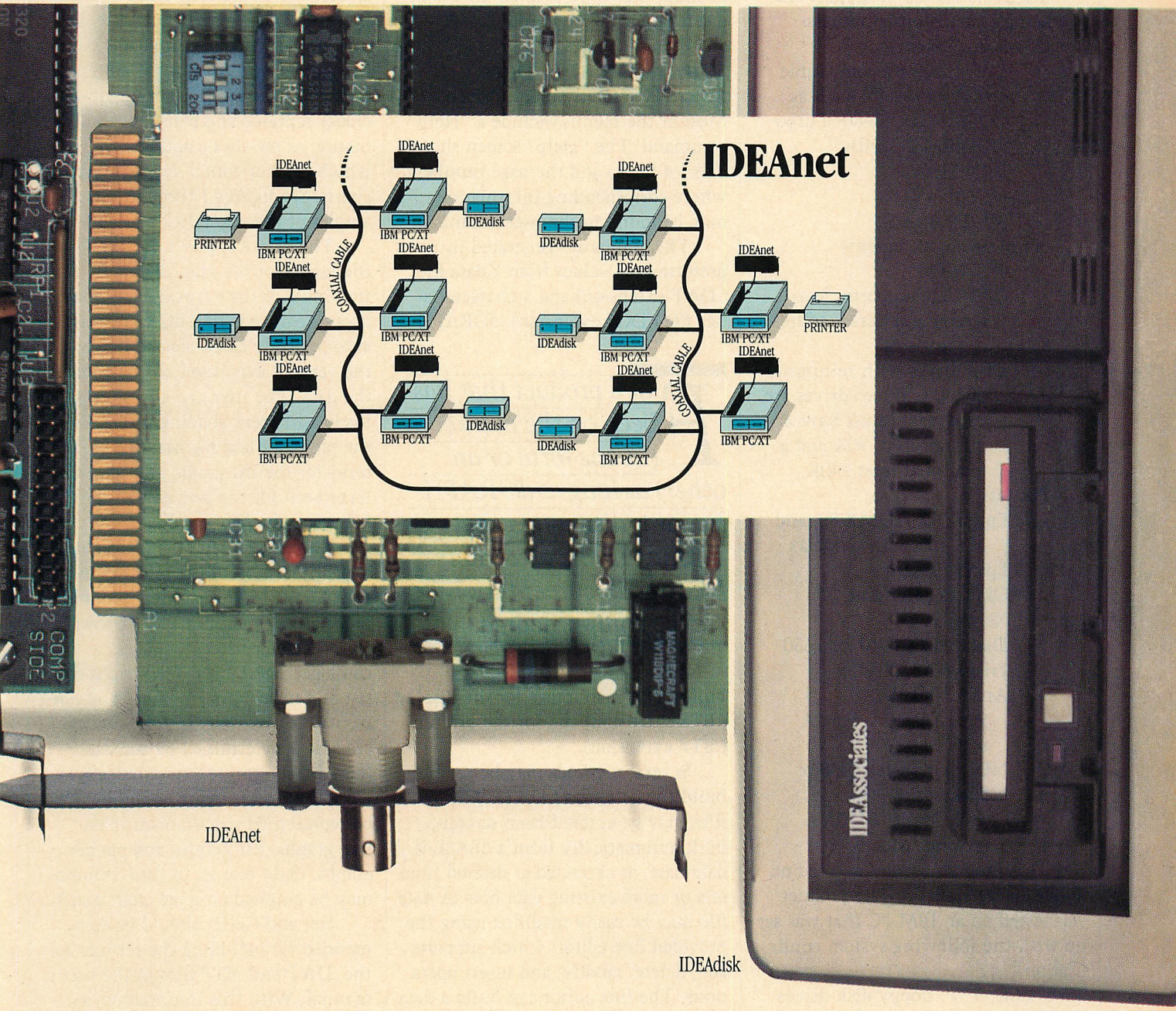
If you simply want to share a hard disk, common data base, printer, or other resources among a few users – and you don't have an arm and a leg to spend – IDEAshare is the answer. IDEAshare is easy to use, easy to install, low cost, low risk. No buzzwords about LANs, coaxial cables, or collision detect technology required here. All you need are standard serial ports, ordinary cable, our IDEAshare software – and you're off and running.

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dGRAPH claims to support the following system configurations:

Operating systems
- CP/M 2.2 or a compatible operating system such as CDOS, I/OS, SB-80, Turbo-DOS IBM PC with:
  - Baby Blue
  - MP/M
  - MS/DOS

Hardware requirements
- 48K RAM
- CRT that supports clear-screen and cursor addressing features
- Disk drives with minimum of 240K. If two drives are used, each must have a minimum of 90K and a total of at least 240K.

Printers
- Epson MX-70, MX-80, and MX-100 with Graftrax
- Epson FX series
- Okidata Microline
- Xerox 1750
- Diablo 630, 1640, or 1650
- Prism 80, 132 series
- Anadex 9000A, 9001A,9500A, 9501A series
- NEC Spinwriter 5000 or 7000 series
- C. Itoh Model 8510A
- DataSouth Model 180

This product review is based on dGRAPH version 1.3. The product was tested on an IBM PC that was set up with the following system configuration:

Two 360K, 5 ¼" floppy disk drives
256K RAM
Monochrome display
Monochrome display and printer board
Epson FX-80 printer

Note that dGRAPH cannot support graphics on the monochrome display without having an appropriate graphics board available. dGRAPH will, however, allow graphs to be printed without actually displaying the graphs on the monitor. Some tests were made to insure that the graphs that were displayed were comparable to those that were printed; no major discrepancies were found.

What dGRAPH Does

dGRAPH is totally menu driven. Most of the menus include a "Help" command. The "Help" screen shows a list of topics and the page numbers where corresponding information may be found in the user's manual.

The graphs are generated using preformatted values from a data file (.DAT extension) and a characteristics file (.DGF extension). dGRAPH builds a bit map image for the display (.BTS extension) and for the printer (.BTP extension).

For a product that has been on the market (in one form or another) as long as dGRAPH has, it is dismaying that nothing in the user interface and documentation can be complimented.

Several methods may be used to build the data files (.DAT). The data files may be entered from scratch, built automatically from a dBASE II data base, or extracted as desired from one or more existing data files. A data file may be easily modified using the provided line editor, which supports add, delete, modify, and insert operations. The line editor can build a data file from the contents of several other data files.

An extended feature of dGRAPH is the ability to retrieve data for graphing from files created by dBASE II (.DBF extension). The data file (.DAT) is created automatically when the graph is drawn. One field in the data base file can be graphed using other fields as the selection criteria. For example, a company with several divisions can graph sales for each division over several months.

Once the data file has been created, there are four types of graphs that may be generated from the data: line graphs in connect-the-dots style; bar graphs that are vertical representations of line graph information; pie charts representing percentage information as pie slices; and pie bars, which are horizontal versions of pie charts. See figures 1 through 4 for examples of these graphs.

The dGRAPH user defines all of the labels for the graphs, as well as the limits of the vertical axis. One useful feature is that dGRAPH can automatically calculate the limits of the vertical axis based on the value of the data. The user can choose from twelve different shading patterns for the pie chart and pie bar, five patterns for the bar graph, and four patterns each for the line graphs and the points on the line graphs.

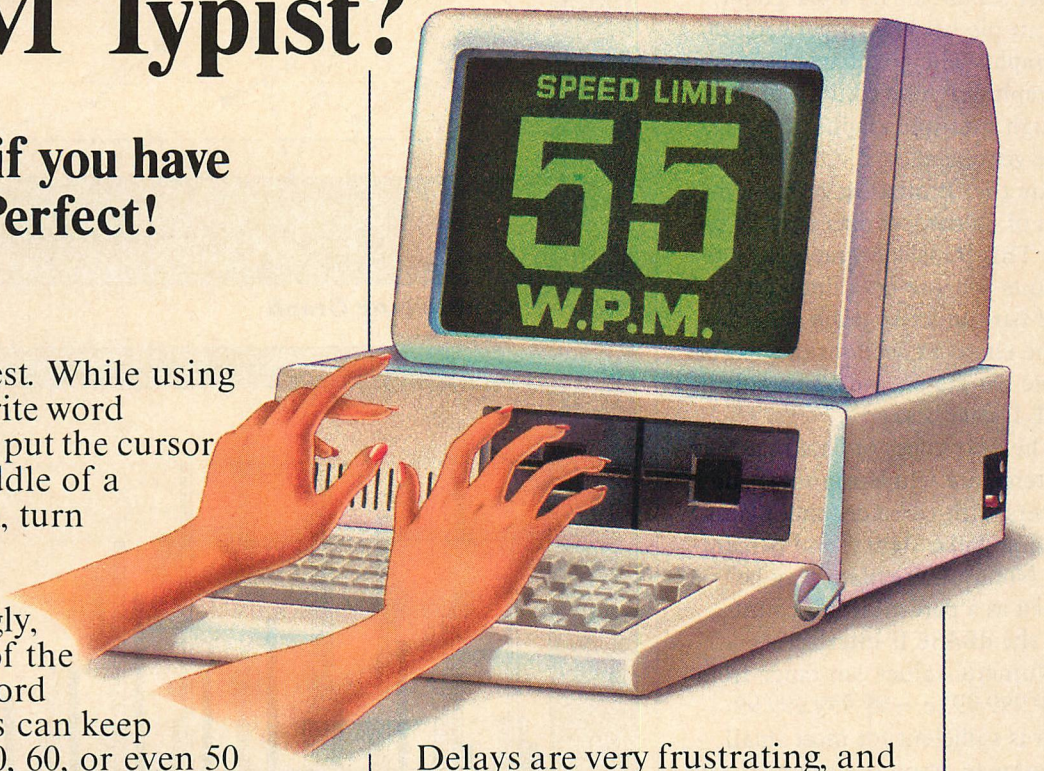
The data stored by dGRAPH are logically arranged into an array of rows and columns with maximum dimensions of 4 columns by 52 rows (i.e., 4 fields per record and 52 records per .DAT file). The graphs consist of a maximum number of 52 horizontal (*X*) axis entries. The vertical (*Y*) axis is determined by the data (may be determined automatically). Up to four sets of data (columns) can be represented simultaneously on line graphs, bar graphs, and pie bar graphs. Only one set of data (column) may be graphed on a pie chart graph.

Fox and Geller should be commended for including the formats for the .DAT and .BTP files in the user's manual. With this information, a user with programming experience can use dGRAPH to automatically generate graphic charts using numerical output from virtually any applications program. A basic program that creates and accesses data files (.DAT) is also provided in the manual as an example of how to interface applications programs with dGRAPH.

Listing 1 demonstrates how to use a device not recognized by dGRAPH. The sample program interfaces with an Epson FX-80 (although dGRAPH does support this printer).

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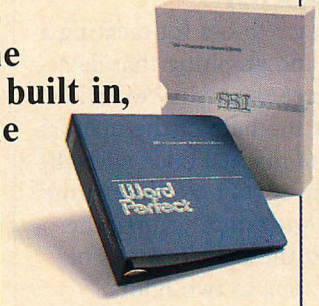
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SSI

LIMITATIONS

There are some limitations to the graphing capabilities of dGRAPH. For example, a maximum of four columns of data may be entered. This translates graphically to four sets of data: four lines on a line graph, four bars per set of bars on a bar graph, and four pie bar graphs per each of two graphs. The pie chart obviously can graph only one column of data, although multiple graphs on a page can be generated.

Another limitation is that a maximum of 52 rows of data may be entered. This translates graphically to 52 points per line on a line graph, 52 sets of bars on a bar graph, 52 slices of a pie chart, 52 sections of each bar in a pie bar graph, and 52 records in a dBASE II data base.

The only types of data that may be entered are whole numbers and numbers with three decimal places (allowing dollar figures and percentages). Non-numeric data may be graphed as a percentage or count using the dBASE II interface.

Numeric values can range from 99,999,999.99 to −99,999,999.99, which is sufficient for most small businesses to graph their annual revenues. The vertical (Y) axis must be numeric. Graph titles may be up to 30 characters in length, and axis labels may be up to 20 characters in length. Finally, dGRAPH does not support logarithmic graphing.

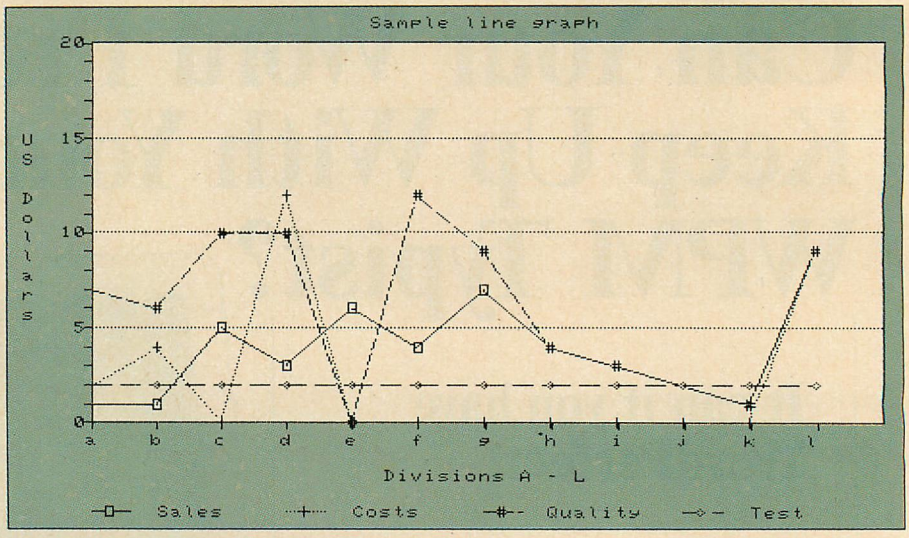


Figure 1: Sample Line Graph

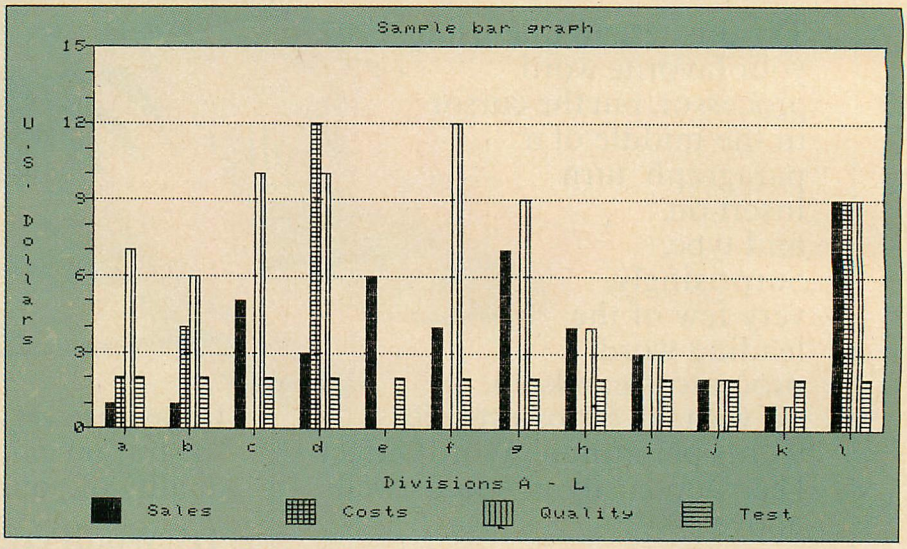


Figure 2: Bar Graph Test Graph

USING dGRAPH

dGRAPH is easy to use for creating a table of data and graphing that data. The menu screens are easy to follow even without the help of the manual. By reading the manual once with the program running (to note the manual's frequent but minor errors), the user can learn the basic features of the system in one to two hours.

The dBASE II interface, referred to by Fox and Geller as the "dBASE II Connection," is slightly more complicated to learn. Once the basic package is mastered, an extra half hour or so is all that is required. The dBASE II Connection is also menu driven; a separate section in the manual is dedicated to it.

dGRAPH uses five intermediate files for storing information on a chart. First, the .DAT file contains the actual data values that will be used to generate the graph. The structure of this file is described in the user's manual, so the file can be created by an applications program. This file is created automatically when the data comes from a dBASE II (.DBF) data base.

The characteristics of the graph itself are contained in a second type of file, which is identified with a .DGF extension. This file contains the axes titles and limits, the shading types, and the relative fields if a dBASE II interface is desired.

The third type of file, an .MGF file, contains the information necessary to generate multiple graphs on a page. The .BTP file, the fourth type, contains the bit-map images of the graph to be sent to the printer. In the fifth type of file, the .BTS file, are the bit map images of the graph to be sent to the monitor.

The data file (.DAT) is automatically generated if the dBASE II file is selected in the graph characteristics file (.DGF). The dGRAPH data file (.DAT) is generated from a dBASE II file (.DBF) according to the following

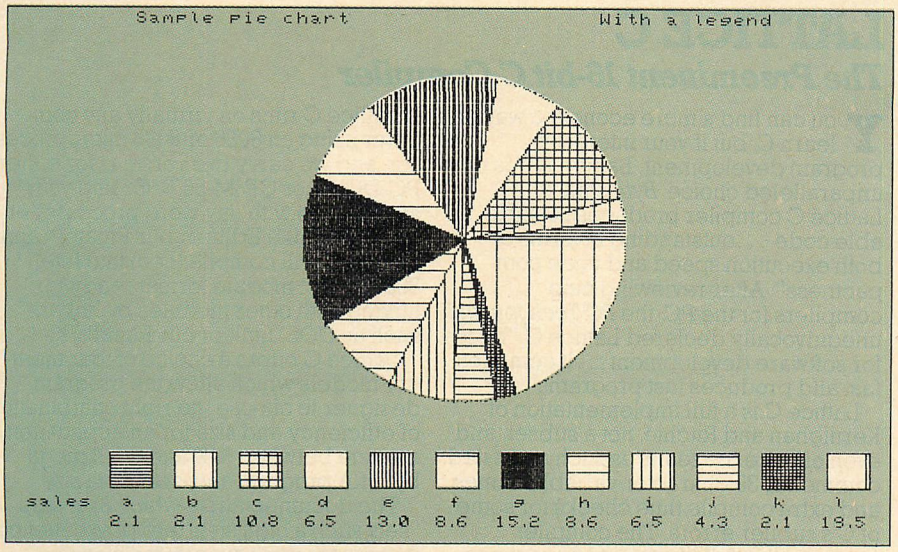


Figure 3: Pie Chart Test Graph

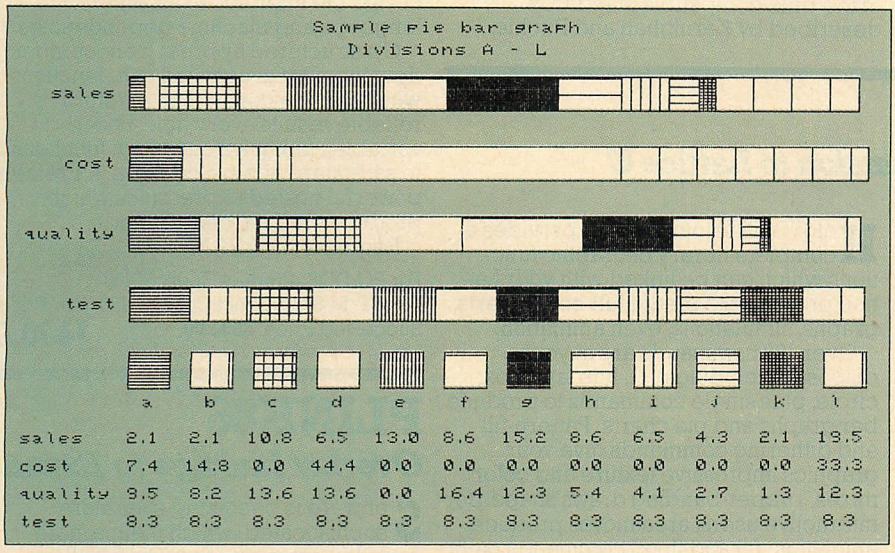


Figure 4: Pie Bar Test Graph

conditions: one field corresponds to the actual data values (for example, revenue), which are graphed on the vertical (Y) axis (maximum of 52 data items). Another field corresponds to the value of a set of criteria for the records in the data base from which the data are to be drawn (for example, month); this value is graphed in the horizontal (X) axis. Another field corresponds to the data used in the line, bar, or pie bar graphs (for example, the division of the company) (maximum of four columns).

By reading through the manual one time with the program running (to note frequent but minor errors in the manual), the user can learn the system's basic features in one to two hours.

Documentation Provided

The user's manual that comes with dGRAPH has installation instructions, a beginner's guide describing how to draw charts using provided demonstration files, detailed descriptions of how to modify the characteristics of the graphs, a description of the logical meaning of rows and columns as pertaining to dGRAPH data files, and information on using dGRAPH with dBASE II data base files. Also included are a discussion of entering and editing data using the file editor provided by dGRAPH, a description of using dGRAPH with other programs by creating batch commands (.BAT extension), a sample BASIC program to create a data file (.DAT), information about interfacing with other devices, and descriptions of the .BTP file format.

There are eight appendices containing samples of dGRAPH menus, customized system configurations, a list of display devices supported, an ASCII table, a description of some dGRAPH error messages, a glossary, sample charts, and information about dGRAPH limitations (field sizes, etc.) The manual also has an index.

Problems

The dGRAPH program's human interface is inconsistent in places. It suffers from numerous problems that, although not serious, could very well confuse the first-time user. For example, saving a data file while in the edit mode resets the editor. To do further edits the file must be selected again.

Also, when a data file (.DAT) for a graph is being built from other data files, the name of the data file in use becomes that of the last file that was referenced, not the one initially specified for creation or modification.

When a file is selected, sometimes it is retrieved immediately, and sometimes the file is not retrieved until it is referenced. When a user finishes updating a file and tries to exit before saving it, sometimes it is saved automatically, sometimes the user is warned to save it before exiting the function, and sometimes the file is just plain lost.

Another problem is that the menus are all formatted slightly differently, positioned on the screen in different places, and offer selections in a different manner.

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Error messages are generated at somewhat random locations on the screen. They remain there for a fixed length of time, after which the user is returned to the menu. Unfortunately, the keyboard buffer is not flushed. Woe to the user who errs while entering a character string. If he's lucky he'll merely sit through several repeat performances of the same error message. If not, one of the characters in the string will match a valid menu choice and he'll probably decide it's time to take a break.

The most annoying problem of all comes up when the user tells dGRAPH to print a graph and then realizes he forgot some parameter. He has two options: grab a cup of coffee and get comfortable or turn the printer off-line to generate a PC DOS error. If he chooses the second option, he can type "A" to the "Abort, Retry, or Ignore" message and restart the program. Although all the menus are escapable (using the <ESC> key), once initiated the draw option cannot be cleanly terminated.

Conclusion

dGRAPH does everything it claims to do. This package is useful for graphing data and, in fact, prints some good-looking graphs. Despite the limited field possibilities, the dBASE II interface is useful.

I did not like dGRAPH, however. The package is overpriced and underpolished. Fox and Geller should not expect the user to tolerate petty annoyances that could easily be corrected. The human interfaces are sloppy and inconsistent. Menu screens need to be standardized, all prompts and error messages should follow the same conventions for all occurrences, and the print function needs to be escapable. The manual should be updated to refer to *MS/DOS* instead of CP/M files and conventions.

I cannot recommend buying the current version of dGRAPH at its present list price of $295.00. If the product were available for $29.50, however, I'd buy it.

dGRAPH
Fox and Geller, Inc.
604 Market Street
Elmwood Park, NJ 07407
201-837-0142
$295.00
CIRCLE 494 ON READER SERVICE CARD

Listing 1 A C Program to Read the Bit Map Image File of the Graphic Output

```
/******
*
*  File name:       MAIN.C
*  Author:          Bob Kephart  and  Steve Johnson
*
*  Copyright (c) 1984 Smith & Smith Associates
*
*  Date:            February 24, 1984
*  Revised:         02/25/84    BY: BK
*
*
*
*  This program reads a .BTP file created by dGRAPH and outputs the file
*  to an Epson FX-80 printer.
*
*  This program illustrates how the .BTP file can be read and output to
*  different devices.  A user with a different type of device which dGRAPH
*  does not recognize may use this program by modifying the data before
*  it is written to the printer into the correct format.
*
******/

#include       <stdio.h>
#include       <ctype.h>

extern int     open (), read (), write (), strlen ();
extern char    *getmem ();


#define    ERROR       EOF                 /* EOF set in stdio.h */
#define    NULL        '\0'                /* null character */
#define    PRINTER     "LPT1"              /* print device */
#define    ESC         '\33'               /* graphics 480 bpl on epson */
#define    LF_SPACE    '3'                 /* set line feed spacing */
#define    SPACE_INCR  '\30'               /* nr of 1/216" incr. for LF */
#define    INIT_CHAR   '@'                 /* initialize the printer */
#define    CR          '\15'               /* carriage return */
#define    FF          '\14'               /* form feed */
#define    LF          '\12'               /* line feed */
#define    PCODE_1     450%256             /* graphics code for epson */
#define    PCODE_2     450/256             /* graphics code for epson */
#define    GRAPH_480   'K'                 /* graphics 480 bpl on epson */
#define    WRITE       1
#define    READ        0

#define    BINARY_DATA 0100000             /* prevents translation of */
                                           /* crlf to '\n' */

#define    LINES_PER_GRAPH 40              /* dGRAPH parameter */
#define    DOTS_PER_LINE   450             /* dGRAPH parameter */

#define    DR_SPECIFIER    ':'             /* drive specifier */
#define    EXT_LENGTH  4                   /* chars in filename ext. */
#define    DR_SPC_LENGTH   2               /* chars in drive specifier */
#define    FBASE_LENGTH    8               /* chars in filename base */
#define    FILENALEN   FBASE_LENGTH + DR_SPC_LENGTH + EXT_LENGTH
#define    DOS_CHARS   "$#&@!%()-{}'_'"    /* chars in DOS 2.0 filename */


/******
*
*   main (argc, argv)
*
*      argc        integer         number of arguments
*      argv        pointer         list of pointers to arguments
*
*      command line interpreter for the program to print dGRAPH .BTP files
*
******/

main (argc, argv)
int   argc;
char  *argv [];
{
   char    filename [FILENALEN], *cpy_dos_fname ();
   int     btp_filenr;

   while (--argc)
   {
      cpy_dos_fname (filename, *++argv);
      if ((btp_filenr = open (filename, READ | BINARY_DATA)) != ERROR)
      {
         printf ("printing %s\n", filename);
         print_graph (btp_filenr);
      }
      else
      {
         printf ("Cannot open file %s\n", filename);
         errexit ("");
      }
   }

   return;
}
```

```
/******
*
*  print_graph (btp_filenr)
*
*     btp_filenr       integer        File number of .BTP file
*
*      Read the bit map image from the .btp file.
*      Set the line feed spacing of the printer.
*      Set the printer to graphics mode with 480 dots per line.
*      Send the graphics output to the printer one line at a time.
*
******/
print_graph (btp_filenr)
int   btp_filenr;
{
   int     prt_filenr;
   int     line_count, dot_count, status;
   char    *io_buf, *graphics_line;

   static char     reset_prt [] = {CR, FF, ESC, INIT_CHAR, NULL};
   static char     init_spacing [] = {ESC, LF_SPACE, SPACE_INCR, NULL};
   static char     init_graphics [] =
                   {CR, LF, ESC, GRAPH_480, PCODE_1, PCODE_2, NULL};


   prt_filenr = open (PRINTER, WRITE | BINARY_DATA);

   if ((graphics_line = io_buf =
   getmem (LINES_PER_GRAPH * DOTS_PER_LINE)) == NULL)
       errexit ("bad memory allocation");

   read (btp_filenr, io_buf, LINES_PER_GRAPH * DOTS_PER_LINE);
   write (prt_filenr, init_spacing, strlen (init_spacing));

   line_count = LINES_PER_GRAPH;
   while (line_count--)
   {
       write (prt_filenr, init_graphics, strlen (init_graphics));
       write (prt_filenr, graphics_line, DOTS_PER_LINE);
       graphics_line += DOTS_PER_LINE;
   }

   write (prt_filenr, reset_prt, strlen (reset_prt));
   rlsmem (io_buf, LINES_PER_GRAPH * DOTS_PER_LINE);
   close (prt_filenr);
   close (btp_filenr);

   return;
}


/******
*
*  is_dos_fsymbol (character)
*
*     character     character        DOS symbol to be verified
*
*      Is the character a legal character for a dos 2.0 filename?
*
******/

is_dos_fsymbol (character)
char   character;
{
   return (isalpha (character)
           || isdigit (character)
           || strchr (DOS_CHARS, character));
}


/******
*
*  cpy_dos_fname (to, from)
*
*      to        pointer        destination file name string pointer
*      from      pointer        source file name string pointer
*
*      copy a dos file name from the string "from" to the string "to"  and
*      append a NULL
*
******/

char   *cpy_dos_fname (to, from)
char   *to, *from;
{
   int count, base_length;
   char    *chk4drv;

   chk4drv = from + DR_SPC_LENGTH - 1;

   if (*chk4drv == DR_SPECIFER)
       base_length = FILENALEN - EXT_LENGTH;
   else
       base_length = FILENALEN - EXT_LENGTH - DR_SPC_LENGTH;

   count = 0;
   while (*from
   && (is_dos_fsymbol (*from) || ((*from == ':') && (count == 1))))
   {
       if (++count <= base_length)
           *to++ = *from;
       ++from;
   }
   *to = NULL;
   strcat (to, ".BTP");

   return;
}


/******
*
*   errexit (string)
*
*      string      pointer     error message to display upon exit
*
*      exit from the program due to fatal error condition
*
**/
errexit (string)
char    *string;
{
    int    errorcode;

    errorcode = 1;
    printf ("\n%s\n", string);
    exit (errorcode, string);
    return;
}
```

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SUSAN GLINERT-COLE

INSTANT GRATIFICATION

A simple program generator for those who would prefer to spend their time customizing an automatically generated template

Although dBASE II can be used to create sophisticated and complex data bases, learning its vagaries requires a certain perseverance and patience. Not everyone is willing to devote the time required to build even a simple data base. For those who do not need a complicated system, or would rather spend the time customizing an automatically generated template, a dBASE II program generator such as QUICKCODE is worth serious consideration.

QUICKCODE is designed to give almost instant gratification. The user merely has to design a "screen" containing all of the data fields such as name, address, and telephone number that are to become part of the data base. When the screen has been created and named, QUICKCODE will generate a series of files and programs that form a coherent data base system. The basic structure, as created by QUICKCODE and called from dBASE II, lets a user add, edit, print, and delete records to that particular data base; print mailing labels or forms; and interface with WordStar. In addition, the QuickMenu facility can be used to generate menus of interrelated data base programs, making it easy to build a relatively complicated hierarchical structure. Because the generated programs are modular, more complex data base management requirements can be satisfied by customizing the code in any or all of the programs.

The program requires an 8080 or Z80-based computer with CP/M and 48K of memory or an 8086/8088-based computer with PC/MS-DOS and 96K of memory; dBASE II version 2.3 or later; one floppy disk drive with at least 200K capacity; a monitor; and a printer. QUICKCODE is not copy-protected, and instructions are given for making back-up copies.

When the screen has been created and named, QUICKCODE will generate a series of files and programs that form a coherent data base system.

QUICKCODE relies heavily on menus to lead the user from level to level. The start-up screen is shown in figure 1. From this menu, one can customize screen design commands and screen settings, design a screen, change output options, turn on the QUICKSCREEN menu generator, and generate dBASE II programs.

The C menu is used to set the system configurations and set the definitions of all QUICKCODE mode commands to user-selected values. If these have been changed, they will automatically be saved with the screen in use in the .SCR file. The selections can be made permanent by saving the entire system file.

Typing "Q" from the main menu puts QUICKCODE into the screen design mode. This facility is simple to use. Basically, the desired data base record is painted on the display. QUICKCODE provides two separate keyboard modes: the standard and graphics. By toggling the graphics keyboard on with F2, the entire assemblage of IBM forms design characters becomes the default character set. Uppercase characters are available using the shift key and the letter.

QUICKCODE provides a rational set of editing keys to erase lines and columns, shift text right or left, center text, go to the beginning and the end of a line, and screen and erase the screen. These functions are invoked by pressing CTRL and a letter key; the key assignments can be customized from both the main menu or from the screen design mode by pressing "?". Unfortunately, there is no destructive backspacing or delete key available. The only way to delete

There's light at the e

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less than a line at a time is by backing up and typing over them.

Three types of objects can be placed on the screen: lines and graphics characters, display-only fields, and data base fields. Display-only fields are used for output only. They are specified in screen mode by preceding a field name with a "%" sign. When QUICKCODE sees a display-only field, it generates a dBASE II statement of the form "@ x,y SAY" followed by the field name. Display-only fields can be up to 10 characters long and can be dBASE memory variables, primary or secondary file variables, or any legal expression that can follow dBASE's SAY statement.

Data fields are indicated by preceding the field name with a semicolon. These fields are for data input and generate statements of the form "@ x,y GET fieldname". In screen design mode, three field types can be specified: character (the default), money (by following the field name with a dollar sign), and integer (by following the field name with a pound sign). Several other data field types can be specified from fields mode.

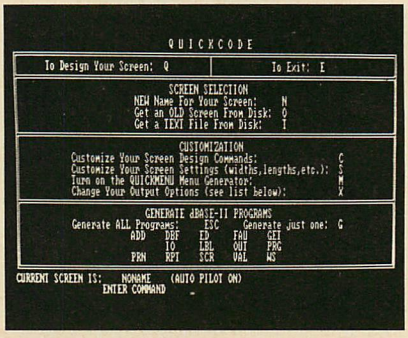
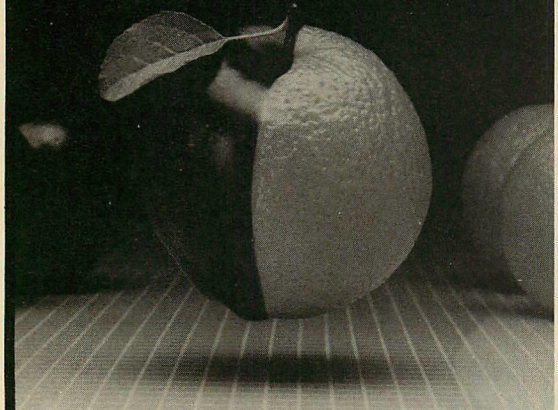


Figure 1: QUICKCODE Startup Screen

The rules regarding field setup inside QUICKCODE are, in general, a result of dBASE II's constraints. dBASE II, for example, does not allow the combined length of all fields to exceed 1000 characters, and QUICKCODE will generate an error message if the screen exceeds this value. The maximum number of fields QUICKCODE allows per screen is 64. However, because dBASE II permits only 32 fields per file, QUICKCODE will actually process only 32 of them. The user must ensure that the field number is within the allowable range for dBASE II, otherwise part of the screen will be ignored when QUICKCODE creates the programs.

Screens can be created with a maximum width of 132 characters. The default width is 80, but the right margin can be changed by using the Setup mode available from the main menu. Screens greater than 80 characters wide can be scrolled horizontally, but a toggle key can also be used to switch between two windows into the screen. As delivered, the left window begins at column 0 and ends at column 72; the right window begins at column 52 and ends with the right margin. Like many other parts of QUICKCODE, these settings can

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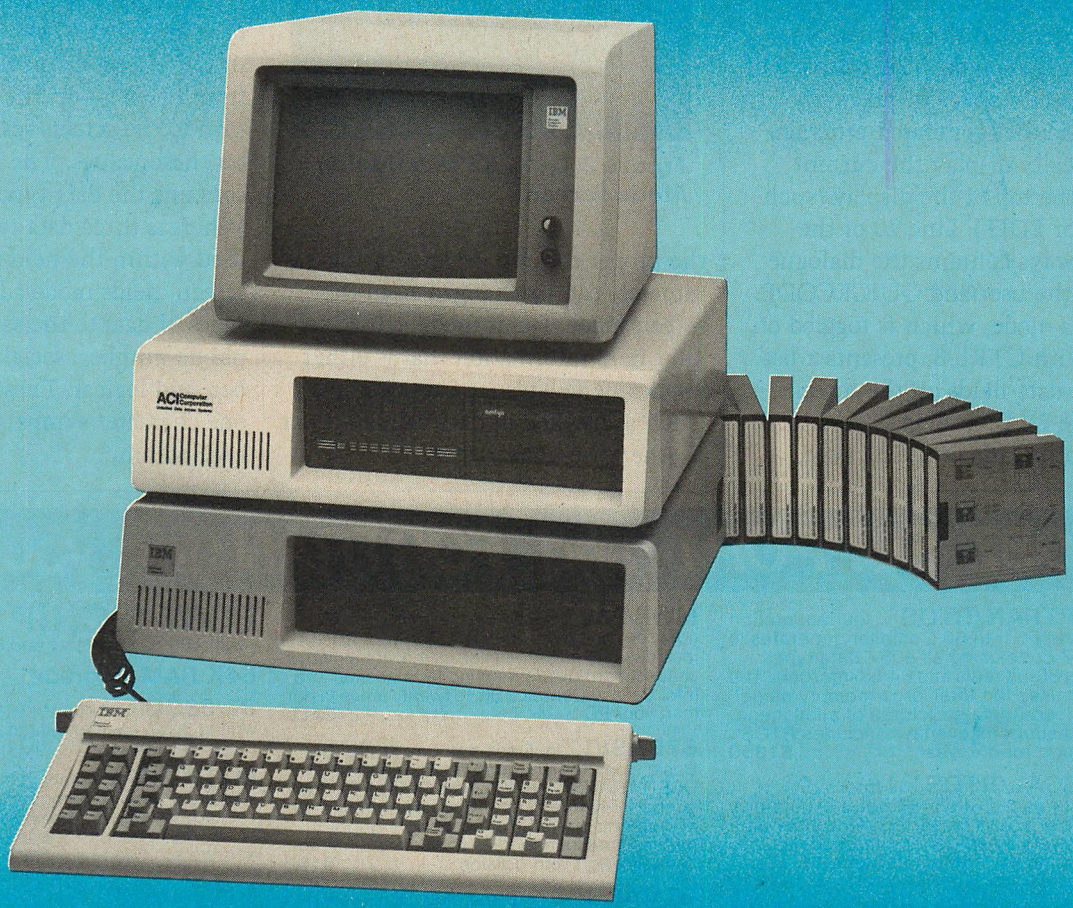
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be changed. The overlapping nature of these two windows makes layout on wide screens much easier.

A user can select values for the screen size, or can opt to turn on QUICKCODE's automatic pilot option, which sets certain defaults regarding the screen and further simplifies the process of setting up the data base. When the automatic pilot is on, the top margin is automatically set to 1, the bottom margin to 20. Forms larger than this cannot be created in this mode. The first line of the screen contains a display-only variable, so that generated programs automatically display the current mode at the top of the display (such as ADD or EDIT). Line 20 of the screen always contains the dialogue between the user and QUICKCODE.

Fields mode, which is toggled on and off with CTRL-B, presents a list of all the data fields on the screen (see figure 2). Each field is described with eight parameters: data type, field length, field status, default, minimum, maximum, error message, and validation method. All parameters are assigned a default value that is changed by entering another value in the proper column. Several of the parameters can be changed from the screen mode. Fields mode is used to alter field information that is either applicable to advanced applications (such as method of data validation) or is otherwise unavailable.

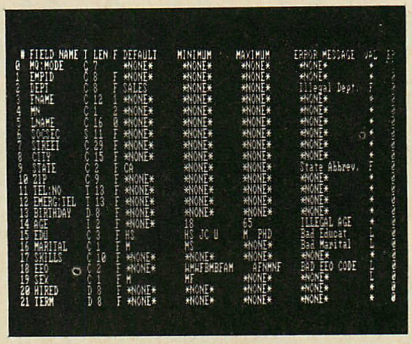


Figure 2: QUICKCODE Fields Mode Screen

The cursor keys are used to move to the desired line or column. Fields mode displays 22 fields at a time; if there are more than 22 fields on the page, CTRL-V will select the next page of information. A new value will only be accepted if it is legal. For example, a field specified as integer on the screen cannot be changed to character in fields mode (although the reverse is allowed).

The field number and name appear in the first two columns. Entries in these areas cannot be changed from fields mode; the user must return to the screen design mode to alter these values. The third column contains the data type of the field. Whereas three data types can be specified within the field name on the screen, fields mode adds several new types of data to the set: date, telephone number, social security number, and logical. These are entered as one-character symbols in the data type column.

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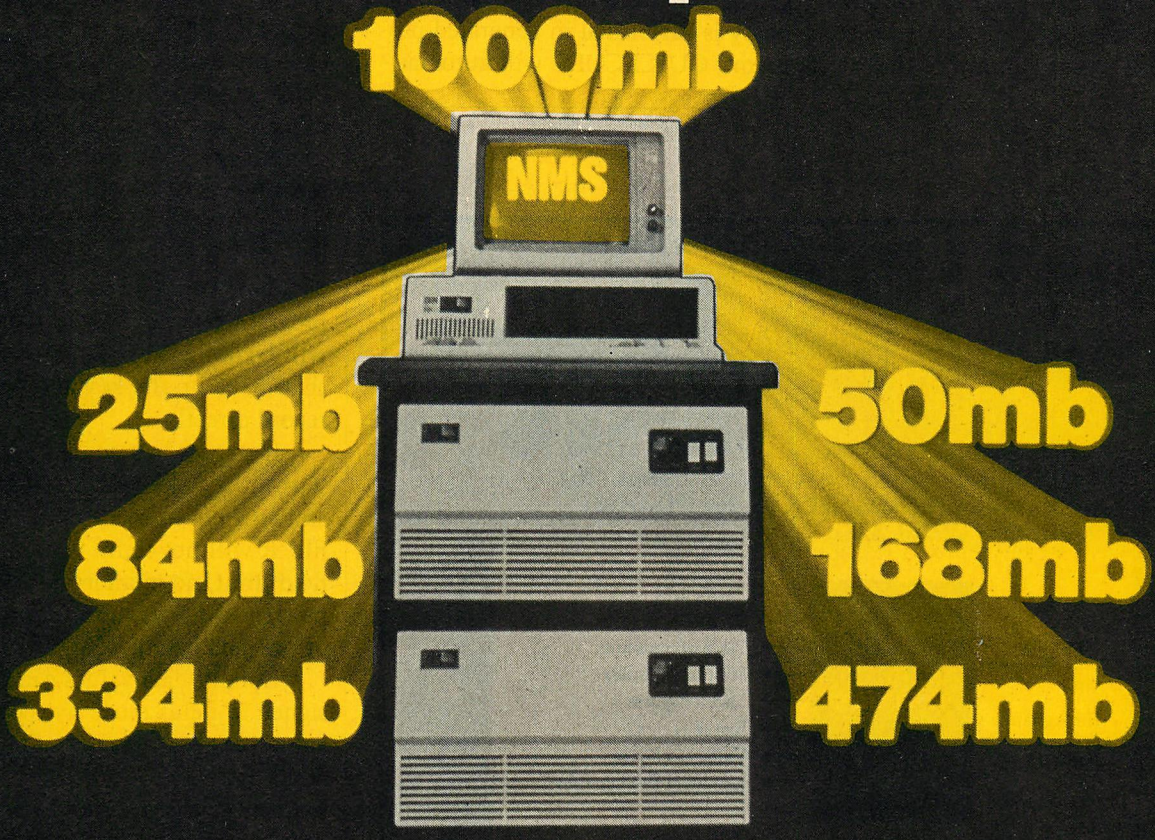
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The field length is recorded in the next column. Each data type has a maximum allowable field length, but if you assign a length number to a field such that a collision would occur on the screen, QUICKCODE will complain and display the maximum acceptable length.

The file status column of the field's mode screen is of interest mostly to programmers. Each data field can have one of three file status values: file field (the default), data base key field, or non-file field. A file field will be part of the QUICKCODE-generated data base; when data entry is performed in generated programs, QUICKCODE will automatically create a dBASE II memory variable corresponding to each file field.

The data base key fields are used with the dBASE II index feature to index the data base records. Only one key per field is permitted; however, the key itself is not restricted to one field. QUICKCODE allows a data base key to be defined on up to ten fields, where 0 is the main (most significant) key field and 9 is the least significant. Thus, if the user desires, records can be sorted by winner's name, then by social security number, then by IQ, and so on. Once the data base key field is set up, the .GET program generated by QUICKCODE will be designed to request all fields that make up the key and get that record directly.

If a space is entered as the file status, the field is considered non-file and will not be placed into the .DBF file, it will not count toward the 32 field limit, no memory variable will be created for it, and it cannot be part of the data base key.

Default data values can be assigned in fields mode by specifying a value in column 6. If a value is entered there, QUICKCODE will automatically place it into the field if no other entry is made. Defaults can be no longer than 11 characters.

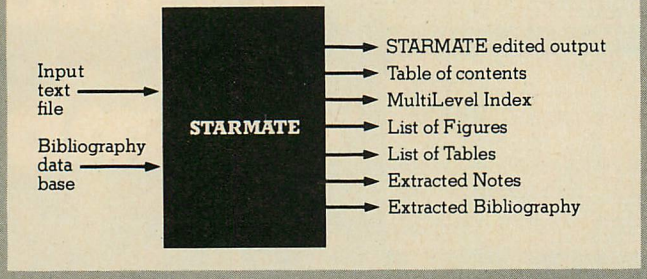
Several columns are assigned to the task of error checking and data validation. Columns 7 and 8, the minimum and maximum columns, are used to set the upper and lower limits on values entered in that particular field. All fields, including character, can have minimum and maximum values assigned to be used for checking valid data entries. If an invalid entry is made, the user can choose to print a customized error message by typing it into column 9. The message can be as many as 14 characters long.

Column 10 indicates the type of error checking, called validation, to be performed on the corresponding field. This checking is done by the .VAL program whenever records are added or edited in the data base.

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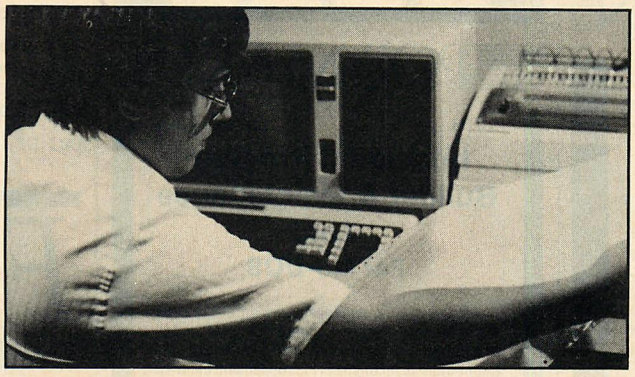
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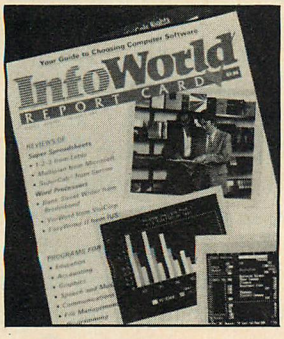
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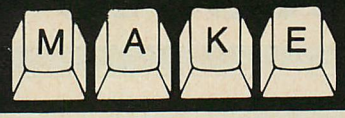
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File checking will accommodate a large number of complicated values that can be easily changed, but it also requires a somewhat more complex setup.

File checking will accommodate a large number of complicated values that can be easily changed, but it also requires a more complex setup. To use this function, a separate data base of allowable values must be created. This validation file is created with QUICKCODE in the same manner as the primary data base system. The validation data base must have the same name as the field being checked. Be aware that the entries made into the validation file result in case-sensitive data entry. That is, if the validation data were entered in lower-case letters, then only lower-case entries will be allowed in the data field being validated. Otherwise, the user will be informed that the value entered is not allowed.

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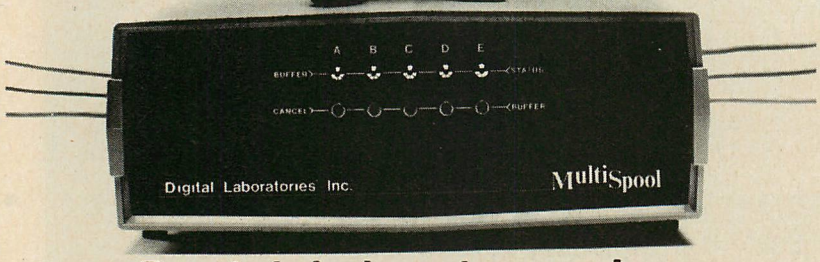


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and field specifications, is generated first. If errors are encountered, the generation procedure is aborted. After the .SCR file is created, QUICKCODE will generate each file or program that has been selected in the X menu.

The following files can be created with QUICKCODE:

.PRG	main command program
.ADD	program generated to add records to the data base
.ED	program to edit records in the data base
.FAU	contains defaults
.GET	program for searching, printing, and deleting records
.GO	program to set up data base index key
.IO	program for screen data entry
.LBL	program to print labels and forms
.MEN	program to generate a customized menu
.OUT	program to generate printed forms
.PRN	screen image for printing
.RPT	file for report generation
.SCR	file containing a screen description
.VAL	file for validation information
.WS	WordStar interface program generator

QUICKCODE also generates an empty data base file to be used with the program. Unless changed to another name, the file will be created with the current data base name and a .DBF extension.

Once the programs have been generated, the basic data base system is run by invoking dBASE II, followed by the data base name. The primary control program from which all the other QUICKCODE modules are called, has the .PRG extension. This program first calls the .GO program, which specifies the initial USEs, INDEXes, and SELECTs appropriate to the data base in use. The .PRG program then sets up an initial menu screen with eight choices: add a record, get/edit a record, run a report, use WordStar interface, print mailing labels/forms, print alternate

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cd	–change directory	**print**	–pr directed to printer
clear	–clear monitor screen	**pwd**	–print working directory
cmp	–compare files	**rm**	–remove files (delete)
comm	–output lines common to two files	**sh**	–shell (command interpreter)
cp	–copy files	**size**	–size of object code
cpio	–file backup/archival	**sort**	–sort numerically or alphabetically
date	–get or set date and time	**sum**	–checksum file
echo	–echo arguments to stdout	**tail**	–output last lines of file
expand	–expand tabs into spaces	**tee**	–pipe fitting
expr	–string and arithmetic evaluation	**test**	–test file's or string's characteristics
false	–do nothing, unsuccessfully	**time**	–determine time to execute a command
find	–produce list of selected files	**tr**	–translate or delete characters
grep	–search files for specified pattern	**true**	–do nothing, successfully
hd	–hex file dumper	**unexpand**	–replace spaces with tabs
head	–output 1st lines of file	**uniq**	–remove duplicate lines
ls	–sorted directory list	**wc**	–count chars, words and lines
more	–copy files to display	**words**	–output file 1 word per line
mv	–move files (rename)		

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mailing labels/forms, exit to DOS, and exit to dBASE II (see figure 3). The .PRG program also sets up the CASE statement that directs the program to other modules depending on the selection. For example, if the user chooses to ADD a record, the .ADD program is called. This module in turn calls the .FAU program to set up default values, the .IO program to get the data values, and the .VAL program to validate the entries. When all records have been added, control is returned to the .PRG program.

The designers of QUICKCODE have paid considerable attention to the problem of output by providing several alternative methods for transcribing the information from the realm of electronic emanations into a more tangible form.

The .OUT program is used to display or print individual records when the .GET program is running. The primary .OUT program is used to display each record on the screen in response to an N (next), P (previous), or S (search). If a printed record is desired, the primary .OUT program can be used for the format,

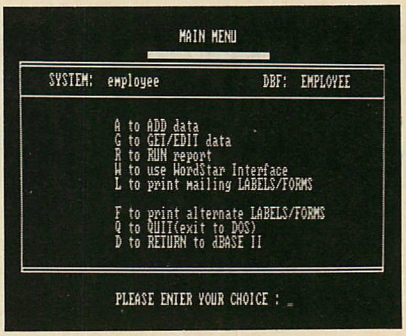


Figure 3: Main Menu generated by QUICKCODE

or a secondary .OUT program can be defined to give a different printout.

Each data base can have two .LBL files associated with it. Typing "L" at the main menu will print mailing labels, or F will print alternate forms or labels. The primary label program has the same name as the main program. The primary program must be based on the data entry screen, which was created in QUICKCODE mode. If mailing labels with a different format are required, an alternate .LBL file must be set up. Selecting a name for this program is done in the setup menu. The program itself is done by creating a completely new screen in the Quickscreen mode, and saving it out to the alternate .LBL name.

The forms/label option will output the reports to the printer in the same format as they appear on the screen. If the user wishes a report format that differs from the created screen, it is necessary to create a .RPT file. Although QUICKCODE will create a file with a .RPT extension, this program does not automatically produce a report if the "run report" option is selected at the main menu. Rather, the user is tossed into the standard dBASE II report generating facility. This has the advantage that the user can establish as many differ-



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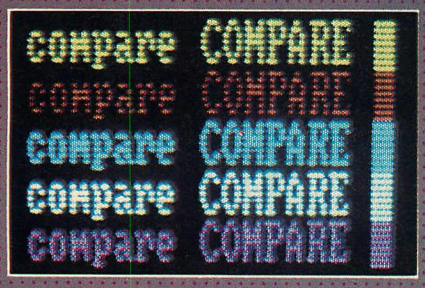
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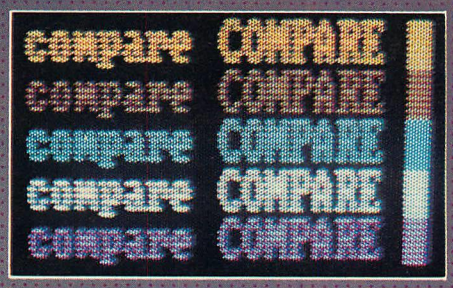
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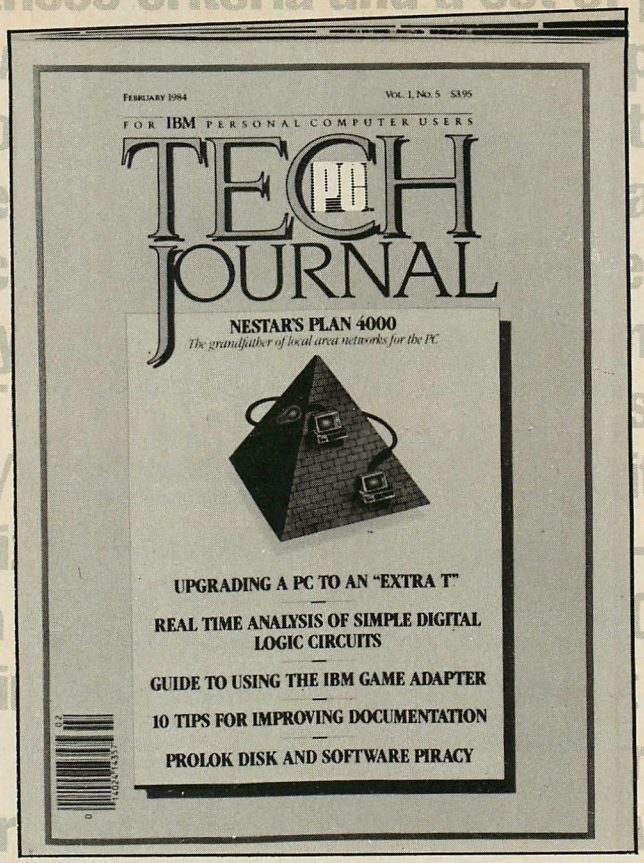
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ent report forms as desired, but the QUICKCODE manual implies that all the programs it creates actually will function when invoked.

If the user wishes to print mailing labels and the defined label is not wider than 32 characters, the program will offer a choice of printing the labels one up or four up. The user can also select the number of lines that he would like between forms/labels, or request that a page eject follow each one.

The WordStar connection is used to get data from the data base into a form that can be used by WordStar, MailMerge, most BASICs, and other languages that can accept files whose data fields are delimited by commas. This feature is accessed by typing a "W" from the main menu. The .WS program will then produce two files: a .DOC file, which can be turned into a form letter by calling it into WordStar, and a .DAT file containing the data in a sequential format. Fields are enclosed by quotes and separated by commas.

The screen associated with figure 2, when processed by QUICKCODE, generated 12 files. Altogether, the 13 files for this data base produced 1,726 lines of code. The code is well commented and cleanly formatted, enabling a programmer to read and customize with no trouble.

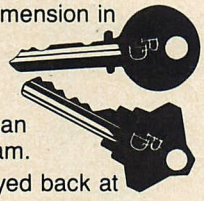
QUICKCODE is easy to use and will create a simple and practical data base management system. It only takes a few hours of practice to become conversant with QUICKCODE's philosophy and limitations.

QUICKCODE is easy to use and will create a simple and practical data base management system. Both the documentation and the human interface are done well and only a few hours of practice are necessary to become conversant with QUICKCODE's philosophy and limitations. Besides being a simple system, QUICKCODE lets the user customize almost every facet of operation, from the key assignments to the dBASE II version. Because it relies heavily on menus, operation is generally self-explanatory and more detailed information can be found in the manual. The code produced by QUICKCODE is neatly formatted and commented, making the task of customization easier for the programmer.

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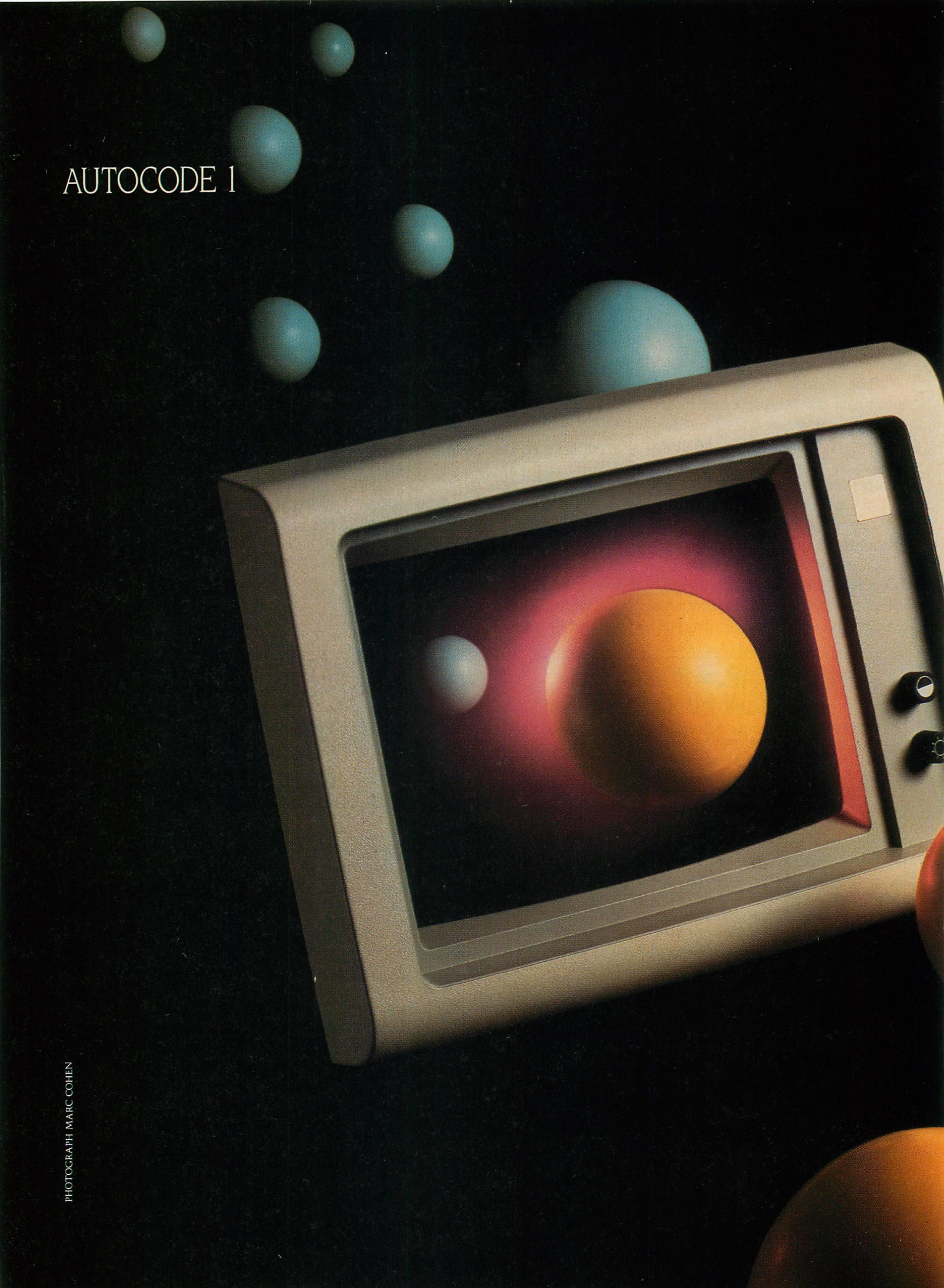
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AUTOCODE 1



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In the brief period of time that Ashton-Tate's dBASE II data base management program for microcomputers has been on the market, it has become a standard to which all data base managers are compared. Even the dBASE II data structure has become a recognized data storage format. Achieving such status does not guarantee that a program is "the best" for all situations, however, because every piece of software is a tool suited to different purposes.

dBASE II is robust, serves many different uses and ends, and has the virtue of being programmable in its unique language. Consequently, dBASE II's usefulness is often limited by the user's command of the dBASE II language. If the user has neither the time nor the inclination to learn this language, a program that generates dBASE II code from high-level input can often suffice.

Chris Christian is a software author and consultant specializing in dBASE II applications.

WHAT IS AUTOCODE 1?

Autocode 1 is a stand-alone program that writes file-maintenance and report programs in the dBASE II language independent of the dBASE II data base manager itself. When Autocode 1 is run, it processes an input file the user has created outside of Autocode 1. A series of menus is presented to the user, and, based on the user input, several files are created on disk. Most of the files created are dBASE II language programs to be used later with dBASE II.

Autocode 1 is a limited tool suitable only for producing simple, repetitive programs. In fact, its limitations may color the user's view of the effectiveness of dBASE II itself.

The product comes on a floppy disk recorded in PC-DOS format. Accompanying the disk is a 8 ½" x 11" three-ring binder containing the 50-page manual. For this review I used Version 1.2 of the program,

dated January, 1983, and Version 1.2 of the manual, dated June, 1983. Autocode 1's list price is $195.00.

What repetitive problem does Autocode 1 solve? Think in terms of a single file at a time: not more than 32 fields. Think about creating the file, and adding, finding, editing, and deleting records. Exclude the idea of checking another file to validate the data entered, or even a list to check.

Include the idea of ranges to check and automatic calculations to make, as well as the idea of reports, as long as they are columnar reports that simply list the file and calculations. Include the idea of the data automatically appearing in a certain order, but forget about changing that order. And picture these capabilities being created by menus presented to the user, with screens on which the user fills in the blanks; these user-designed screens will then appear as menus when dBASE II is used. These capabilities summarize Autocode 1, which turns dBASE II into a simple, single-file system with limited data validation and simple reporting.

How Does It Work?

The kernel of the Autocode 1 concept is a single screen picture that the user creates, showing the information he wants stored as it would appear for a single record. The user must create the text file with the "screen picture" with some program outside of Autocode 1. It could be created with a word processor, such as WordStar in nondocument mode, or by the dBASE II MODIFY COMMAND function.

The screen's function is twofold. First, it tells Autocode 1 how an individual record of the data base should appear on the screen. When new records are entered or existing ones maintained, this screen is the format dBASE II will use. Second, parts of the screen define the size and type of the data to be stored in the data base.

Figure 1 shows an example of such a screen. On this screen, NAME and ADDRESS are text fields 11 characters long. Two fields are used to make up the ADDRESS. BALANCE is a numeric field the user will enter, and MONTHLY INTEREST is a field Autocode 1 calculates based on a formula the user gives it. Finally, DEPOSIT DATE is a date field of the form MM/DD/YY.

```
Name          XXXXXXXXXXX
Address       XXXXXXXXXXX
              XXXXXXXXXXX
Balance       9999.99
Monthly                  Deposit
Interest      9999.99?   date @
```

Figure 1: Example Autocode 1 Screen

```
Name          #1
Address       #2
              #3
Balance       #4
Monthly                  Deposit
Interest      #5         date #6
```

Figure 2: Example Screen with Field Numbers

When Autocode 1 is started from PC-DOS, its main menu is shown on the screen. The four options presented are these:

<1> MENU GENERATION
<2> FILE MAINTENANCE GENERATION
<3> REPORT GENERATION
<4> EXIT

Select <2> and Autocode 1 processes the specified screen file. When it does this processing, it assigns field numbers to the fields it finds. Figure 2 shows how Autocode 1 views the screen created in figure 1.

The screen analysis is a critical part of Autocode 1's services. Following the screen analysis, the user is prompted to identify which character fields make up the key fields of the data base. By key fields, Autocode 1 means the data base fields (up to five) that are used by dBASE II to make up the index file that accompanies the data base. The sorted order of these fields determines forever the order of the records as they appear in any reports done with the programs created using Autocode 1.

Next, Autocode 1 prompts for the formulas dBASE II will use to determine the value of calculated fields. The "?" at the end of "Interest 9999.99?" isn't a mistake. It tells Autocode 1 that "Interest" is a calculated field. For example, the formula "#4*.01" says to take the value of field 4 (BALANCE) and multiply it by .01 to get the interest amount.

Note that from the screen analysis onward, the user must communicate with Autocode 1 about the data fields using "#1," "#2," and so on. This is needed first when Autocode 1 asks for the formulas for any calculated fields and is also used during report generation. The generated code refers to fields with the names FLD1, FLD2, etc.

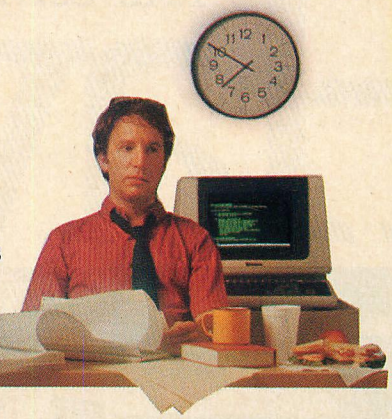
Following the calculations dialogue, Autocode 1 has the user fill in a screen describing the minimum and maximum values for each field, so that the maintenance program Autocode 1 generates can perform a range check on the data entered. Autocode 1 correctly handles the conversion to numeric or character values for each field. The "@" next to "Deposit date" in the example above shows how a date datum is indicated.

The "Date field," a non-dBASE II field type invented by Autocode 1's authors, is handled by the maintenance program in the form "MM/DD/YY" for the screen displays. Internally, date fields are stored as six-character fields of the form YYMMDD, which allows correct sorting, should the date be a key field. For date fields, maximum and minimum apply only to the year, since Autocode 1 automatically checks that months are in the range 1-12 and that days are in the range 1-31 (yes, it does allow 02/31/84 to be entered as a date, because the date check is not rigorous).

After the range check screen has been completed, Autocode 1 creates a summary of what it's done. The user

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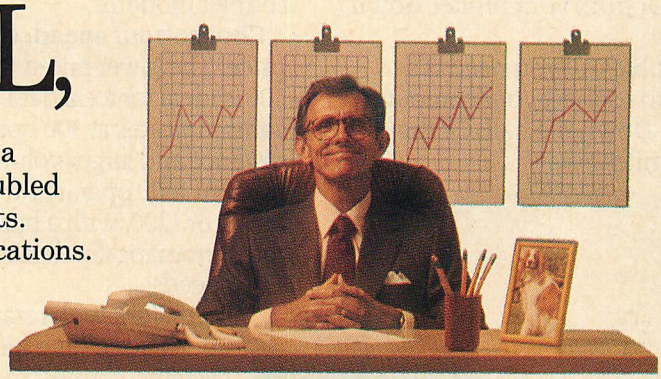
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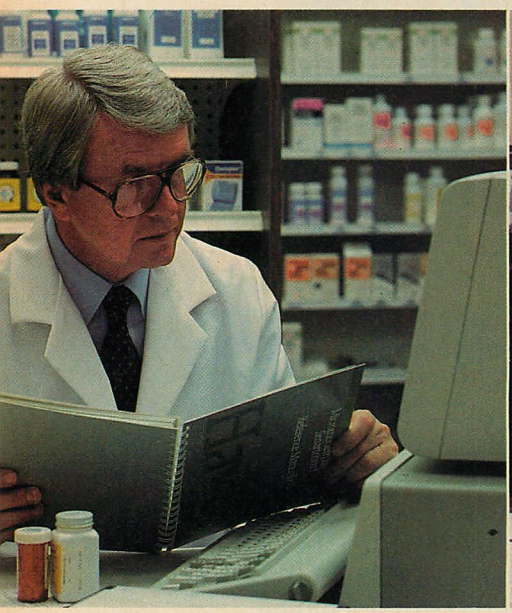
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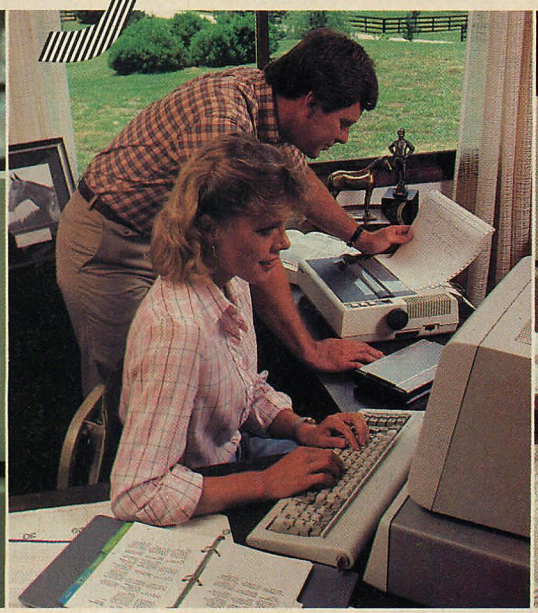
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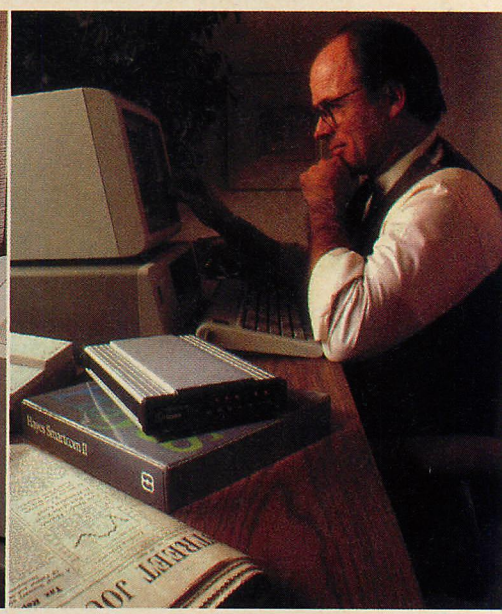
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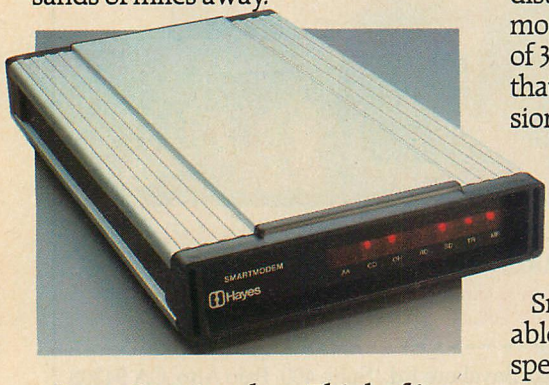
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AUTOCODE 1

determines whether the summary goes to the screen or to the printer. At this point, the dBASE II file-maintenance program is created and placed in a user-named file, and an empty dBASE II file is created with the same name as the input screen file. dBASE II creates the index file the first time the maintenance program is run.

CHANGES TO PROGRAMS GENERATED BY AUTOCODE 1

There is one technical flaw with the file-maintenance program generated by Autocode 1. The look-up key is created incorrectly from the input values. An example in the documentation gives the command as

```
STORE MFLD1+MFLD10 TO
  MKEY
```

When leading blanks are used in key fields (and they would be for numeric-like fields by more sophisticated users, because Autocode 1 requires the key fields to be character type), a subsequent FIND of the record will fail when dBASE II interprets the FIND &MKEY statement. An attempt to find a record with the key '1' will never succeed. The correct command is:

```
STORE ' '' '+mfld1+mfld10+' '' '
  TO mkey
```

The FIND &MKEY statement will then interpret correctly, because it will be interpreted as FIND ' 1.'

Some of the generated code is long-winded, as is typical of a program generator. The section

```
IF # = 0
STORE F TO FOUND
ELSE
STORE T TO FOUND
ENDIF
```

can be replaced by the statement

```
STORE # > 0 TO found
```

A similar "IF *" condition can be replaced by "STORE * TO deleted."

The generated code actually has no indentations, nor does it place dBASE II variables in lower-case as is conventional. I made these changes to the file-maintenance program in about ten minutes and changed the 8000-character file to a 10,000-character file that is more readable and executes just as quickly. A more readable file is easier to modify, for those who choose to do so.

How easy is it to modify the file-maintenance program? In general, quite easy. The most likely change is to add appropriate PICTURE clauses

When leading blanks are used in key fields, a subsequent FIND of the record will fail when dBASE II interprets the FIND & MKEY statement.

to the GET statements. For the example in the documentation, in which a certain four-character field must be upper-case in order for a report selection to work, this change is in order:

```
old statement: @ 6, 15 GET FLD5
new statement: @6, 15 GET fld5
  PICTURE '!!!!'
```

Similarly, the alphabetic range check on the field is pathetic (but it does force the user to enter upper-case characters). In the example, valid responses are "ENG," "CONT," and "NONE." I would replace the code

```
IF FLD5 >= 'CON' .AND. FLD5
  <= 'ENG'
STORE T TO VL5
ENDIF
```

with

```
STORE '¦'+fld5$'¦ENG
  ¦CONT¦NONE' TO v15
```

In the new code, if "¦" concatenated with the FLD5 answer is found in the string "¦ENG¦CONT¦NONE," the field is valid, and VL5 takes on the logical value "true." For example, if the user enters "ENG" (forced to upper-case by the PICTURE clause I

added), then "¦ENG" can be found within the test string. If he enters "EGGS," then "¦EGGS" cannot be found within the test string, and the answer is invalid. The "¦" makes sure that a spurious match doesn't occur.

Suppose someone did want to look up the entry for FLD5 in another file. If it occurs in the file, it is valid data; otherwise it is not. In the example in the documentation, FLD5 is in fact the breakfast code for travel customers. Let's say a user has created a simple, single-field file called BRKFSTCD.DBF containing the valid breakfast codes. The field in the file is also called BRKFSTCD. This program fragment will validate an entry:

```
SELECT SECONDARY
USE brkfstcd
LOCATE FOR brkfstcd=fld5
STORE .NOT.EOF TO v15
SELECT PRIMARY
```

This simple five-line addition to the generated program is accomplished like this: first, the user activates dBASE II's second file area, since the Autocode 1 generated program always deals only with the primary file area; then he opens the BRKFSTCD.DBF file for the secondary area; and finally, he locates the first record where the field BRKFSTCD matches the value of FLD5 in the primary file.

EOF is a predefined variable that dBASE II sets "true" when the file is positioned past the last record. If EOF is "not true," dBASE II locates a record that matches.

EOF is a predefined variable that dBASE II sets "true" when the file is positioned at the end, past the last record. If EOF is "not true," dBASE II located a record that matches. Thus, V15 is set "true" when a matching record was found, and set "not true" when no matching record was found. Incidentally, since most valid-code files are small, using an index on the file only slows things down. Opening the index file, reading it, and closing it takes more time than simply reading an entire small file.

These examples of modifications to file-maintenance programs generated by Autocode 1 illustrate the robustness of such programs. What about the limitations?

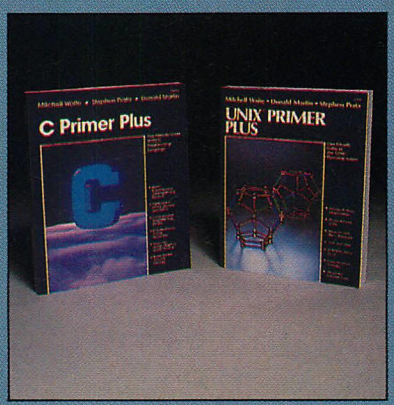
Consider a data base of names and phone numbers. Usually, the user wants to report the data base in alphabetical order by name. But perhaps he also wants one report in which the listing is in numerical order by phone number. There are two ways to do this by modifying the Autocode 1-generated programs.

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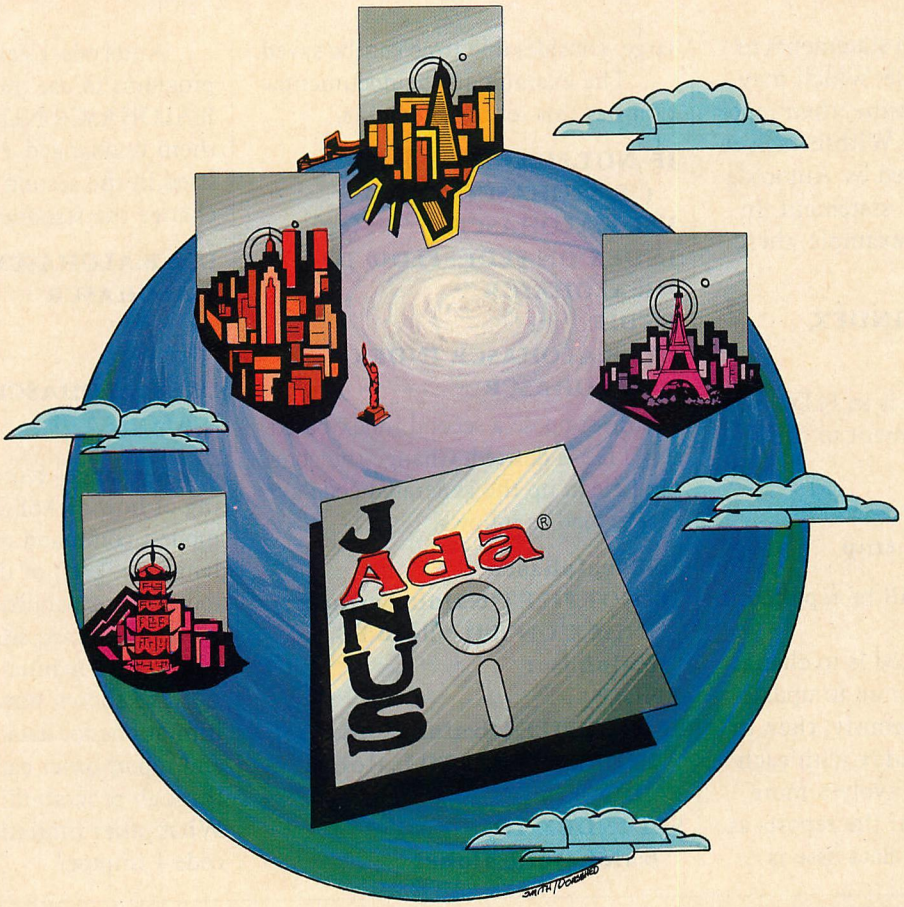
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numerical order. Add statements to create a new index file, which may take some computer time, then report the file in that order. Within each report program generated by Autocode 1, there is one "USE" statement. In the documentation's example, there is this statement:

```
USE B:ALOHASCR INDEX
  B:ALOHASCR
```

If the phone number is in FLD2, simply change that statement to this statement pair:

```
USE b:alohascr
INDEX ON fld2 TO tmp
```

Now the data base will be reported in the appropriate order.

The second method is to change the maintenance program to update two indexes simultaneously, then to use the appropriate index with each report. This method involves more program editing, but if the reports are run frequently or the data base is large, considerable time can be saved.

The example in the documentation has this set of statements:

```
IF .NOT.FILE
  ( 'B:ALOHASCR.NDX' )
USE B:ALOHASCR
INDEX ON FLD1+FLD10 TO
  B:ALOHASCR
ENDIF
USE B:ALOHASCR INDEX
  B:ALOHASCR
```

Again, suppose a second index based on FLD2 is desired. Change the code (and clean up the generated code a bit) to read as follows:

```
USE b:alohascr
IF .NOT.FILE ( 'b:alohascr.ndx' )
  INDEX ON fld1+fld10 TO
  b:alohascr
ENDIF
IF .NOT.FILE ( 'b:aloha2.ndx' )
  INDEX ON fld2 TO b:aloha2
ENDIF
SET INDEX TO
  b:alohascr,b:aloha2
```

Autocode 1 generated the report programs to use the data file in B:ALOHASCR.NDX file order. Leave them unchanged. For the reports desired in the second order, simply change the statement:

```
USE B:ALOHASCR INDEX B:
  ALOHASCR
```

to:

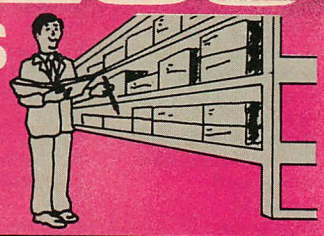
```
USE B:ALOHASCR INDEX B:
  ALOHA2
```

These changes require an understanding of how dBASE II works and a modest command of the dBASE II language. Each of them extends Autocode 1's capabilities significantly. None of them is suggested in the Autocode 1 manual.

I've shown how Autocode 1's limitations for data-validity checking and report order can be overcome through programming competence. What other limitations does Autocode 1 impose?

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One bothersome limitation is the suitability of the file-maintenance program scheme for many applications. Specifically, it is designed for applications in which the user can easily and comfortably fill in the field(s) precisely in order to retrieve a single record. This works only for applications in which each record *can* be uniquely identified.

What if there are two Mr. Smiths in the customer base? The user enters the Mr. Smith from Albuquerque, then the one from New York. Later, when he fills in the key field with "Mr. Smith," the record for Albuquerque is retrieved. The record for the Mr. Smith from New York can't be filled in unless additional key field information is added.

Most users will respond with simple creative data entry, e.g., "Mr. Smith (NY)" for the name. But will they remember to retrieve Mr. Smith's records correctly? They might, but an occasional user of the system probably wouldn't. Finding a way to handle identical records can be difficult. This general problem is often termed *accepting duplicate keys*. One limitation of Autocode 1 is that a program generated by that package will not accept such duplicates.

Alternatively, the data may be entered more explicitly—for example, by entering "Mr. Arnold Smith" and "Mr. George Smith." This makes each record unique but is no help when the user can't remember Mr. Smith's first name. Which one is "Smitty" from New York and, more importantly, how can the user find out who's in New York with a name like "Smith"? These are problems that the dBASE II language can solve in many elegant ways. Such solutions are not included with Autocode 1.

Imagine this scenario. A user enters a name to retrieve a record, and there is no match. With an improved Autocode 1, this prompt appears:

```
[Record Not Found]
[Choice] <E>=Enter
  <R>=Retry <T>=Try
  harder <X>=Exit :
:
```

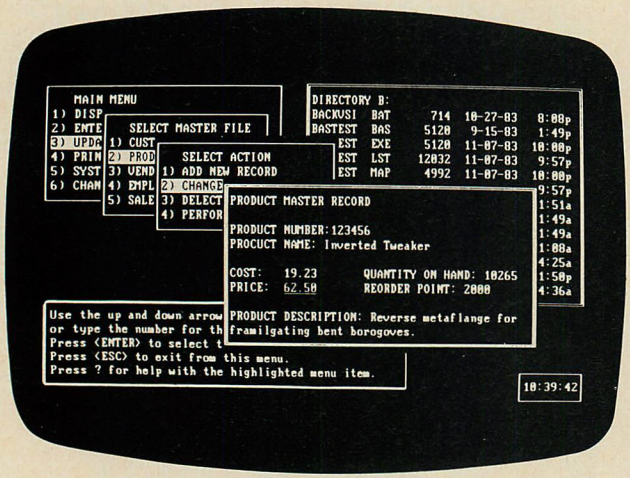
If the user selects "Try harder," the program will use the LOCATE/CONTINUE record-positioning technique of dBASE II to try to match the field that was entered as a portion of the key field.

Another scenario is this: when the key fields are entered, the key used for the index search is formed by discarding trailing blanks. In the single-field index case, the statement is similar to this:

```
STORE '"'+TRIM(mfld1)+'"'
  TO mkey
```

The "FIND &MKEY" statement will then locate the first record that matches the key fields for as much as the user has entered. Thus, "SMI " retrieves the record for "SMITH, AR-

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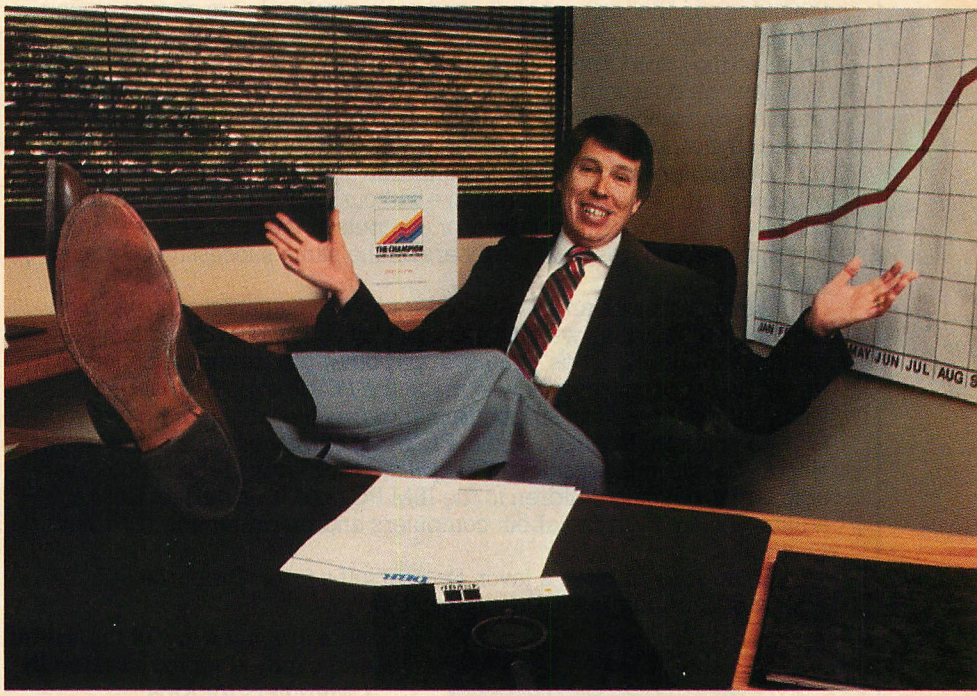
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NOLD." In order for this to be useful, one other change is required. When a record is found, the prompt should read:

```
[Record Found]
[Choice] <A>=Amend
  <D>=Delete <N>=Next
  <C>=Continue <X>=Exit
: :
```

"Next" would cause the next record in the data base to be retrieved and displayed. Because the "apparent order" of the data base is the order of the index, skipping would lead to the next closest match to the key field that was entered by the user.

One other change to the file-maintenance program generated by Autocode 1 would help keep those "Mr. Smiths" distinct. The single statement

```
@ 0,0 SAY '[Record '+STR(#,5)+']'
```

displays the current record number in the left top corner of the screen as, for example, "[Record 1]."

The enhancements discussed above illustrate two points. First, the dBASE II programs generated by Autocode 1 are limited in scope. Nonetheless, nonprogrammers can use this product to create genuine dBASE II applications, provided the caveats about ease of use mentioned above are kept in mind. Second, the programs Autocode 1 generates are robust, and a few well-placed lines of code can increase their sophistication.

WHAT ABOUT REPORTS?

From the Autocode 1 main menu, select <3> REPORT GENERATION, and Autocode 1 begins report-program creation. Start by entering the name of the screen file. When Autocode 1 processes the file the user has created, it once again assigns field numbers to the fields it finds.

At this point Autocode 1 presents a screen describing the report characteristics, which the user fills in. People used to running the dBASE II report generator will find the questions familiar and equally unhelpful.

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I've never found the questions entirely self-explanatory.

For example, who would guess that it is possible to subtotal on a character field? What this means is that dBASE II will print all the totals it has accumulated when the "subtotal field" changes its value. This feature can be used to print budget totals for each department if the data base is ordered by department when the report is printed.

If it is desirable that reports be displayed on the screen, which the Autocode 1 generated program can do, remember to set the lines/page to 20 and double spacing to "N" for no, unlike the example in the Autocode 1 documentation (more on that later).

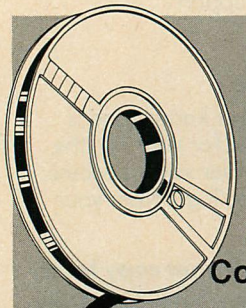
Other than its use of screens to fill in, nothing in Autocode 1's operation is greatly different from the dialogue that the user conducts with dBASE II when creating a new report form. The user does tell Autocode 1 the fields he wants using #1 and similar indicators; otherwise, it's mostly the same. Calculated fields can be expressed as (#4+#6+#8)*.20, and partial character fields can be specified. The result of the initial dialogue is a dBASE II .FRM file containing the report form specifications.

The next phase of Autocode 1 report generating is more interesting. Here Autocode 1 allows selection criteria to be entered, such as "#5 >= 1000.00." Up to three criteria can be entered, and the user must tell Autocode 1 whether *all* criteria (.AND.ing the conditions) or *any* criterion (.OR.ing the conditions) must be met. The result is, in every case, a 31-line dBASE II program that takes care of the report destination (printer or screen), the selection criteria, and paging the report when the screen is selected as its destination.

Once Autocode 1 has created the dBASE II report form file and created the dBASE II program that does the record selection and output device selection, running dBASE II does the rest. In other words, the result is no different from what a user could do himself by struggling through the dBASE II report generator dialogue and learning the appropriate one-line "REPORT FORM formfile FOR whatever TO PRINT" command. The report generator in dBASE II has always been criticized as very limited. Autocode 1 merely makes that limited capability more accessible.

Since access to the dBASE II report generator is the principal report product that Autocode 1 creates for you, let's stop and take a look at that report generator in terms of the criteria for appropriateness.

People who frequently create new reports that use the dBASE II report generator may like Autocode 1's screen interface. But there's a problem here. Frequently a user wants to use the same report form but different selection criteria. The "SET HEADING TO whatever" dBASE II



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command is used for this. An old form with new selection criteria is used, and the heading is changed so that the user knows which report is which—that is, so he can tell what the selection criteria were.

Autocode 1, on the other hand, creates a new report form for each report. Similarly, if the user wants to set selection criteria and then run several reports, Autocode 1 won't help. Each Autocode 1 report is independent of any others.

This aspect of the dBASE II report generator can present problems. What if, for example, the report won't fit all on one line for each record? If a columnar report with a single line per record is adequate, a user might be happy with the Autocode 1/dBASE II combination. But if a user needs a report to be generated so that it could be modified, the Autocode 1/dBASE II combination fails the complexity test. There is little that can be modified in the report command files/report forms generated by Autocode 1.

MENU PROGRAMS GENERATED BY AUTOCODE 1

The file-maintenance dBASE II program and the report-generating programs created by Autocode 1 can be invoked directly from dBASE II. In most cases, it's appropriate to tie them all together with a selection menu, and Autocode 1 provides for the generation of dBASE II programs to accomplish this.

From the Autocode 1 main menu, select <1> MENU GENERATION, and Autocode 1 begins the menu program creation by presenting a screen form to fill in. Start by entering the name of the desired new menu program. Next, enter a one-line title for the menu. Finally, enter the number of options (up to 9) that should be presented in the menu.

For each option, Autocode 1 prompts for an option message (the menu entry), then for the name of a file containing a dBASE II program that should be performed when the



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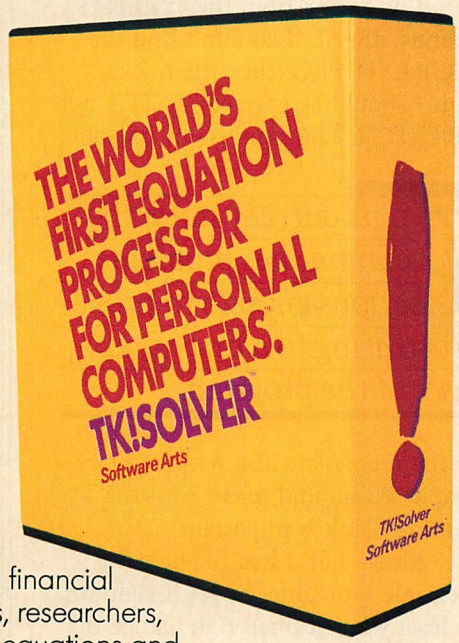
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option is selected during dBASE II's use. There are two special answers to the "FILE TO EXECUTE" question: RETURN, which allows this menu to return to a previous menu, and EXIT, which causes dBASE II to quit and return the user to PC-DOS.

The scheme Autocode 1 uses allows menus to invoke other menus, so that a "Reports" option can lead to a reports menu. The menu generation is simple to do, and the dBASE II programs generated were done well.

THE AUTOCODE 1 DOCUMENTATION

Many of the problems I found while testing Autocode 1 were the result of foolishly following the examples in the documentation. Autocode 1 doesn't help the user along much, since there is no help facility, no "back up one step" or "return to previous menu" key, and no "return to main menu" escape route. But the need for these features would be less urgent if the documentation were better. It is rampant with minor errors, some of which are capable of causing serious problems for nonprogrammers. Many of them are errors of omission—and, in this case, what you don't know *will* hurt you.

It's too bad that these errors exist, since the concept of the documentation is sound. Like Autocode 1 itself, the documentation is modest in its aims. It is of appropriate size, moves quickly along through the examples, and looks like it has all the right things. It just abounds with sloppy errors, however, and they spoil it.

The use of Autocode 1 is illustrated with a thoughtful example. The example is followed throughout the discussions of Autocode 1's capabilities: screen file creation (using the dBASE II MODIFY COMMAND function), menu generation, maintenance program generation, and three reports, illustrating various report selection capabilities. All the Autocode 1 field types are used. Unfortunately, the screens shown in the book don't match what actually appears.

The data in the appendix can't be entered using the screen from the example (some of the data items are too long for the fields; others don't match the minimum/maximum criteria). Working from the example's menus, dBASE II couldn't find the file B:EXIT.PRG (the "file to execute" should be entered "EXIT," not "B:EXIT"). The expressions for some

In its current state, the manual has problems serious enough to prove frustrating to a first-time user of the program.

of the reports are also wrong (for example '75' should read ' 75'—the leading blank is important).

Altogether, I had to enter the example four times to get it right, or at least what seemed right, since the data in the appendix couldn't possibly generate the reports shown. Most of the documentation shows carelessness and could be improved with careful editing and testing. In its current state, however, the manual has problems serious enough to prove frustrating to a first-time user.

Now, the omissions. I was never able to determine what the ".KDT" file created was. Autocode 1 itself should delete it to clean up. Again, file-handling, from the user's point of view, is a serious problem with Autocode 1. No file directories are available from the program, which would be acceptable if there were an "escape to main menu" key. One convention is to assume that if the user enters no file name, he does not want to perform the selected function.

More disturbing, however, is that Autocode 1 deletes any previous file without warning. This is unkind for report forms and the like, but unforgivable for a user's data base. Actually, the documentation never states that the data base file and index files are created by Autocode 1 or its generated programs, nor does it caution



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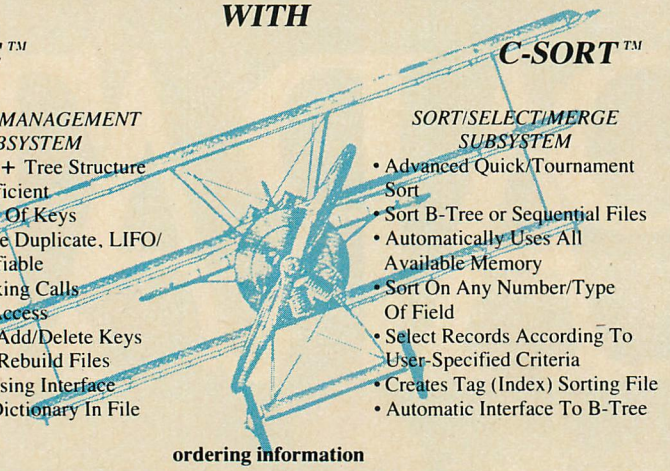
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that data files will be erased at certain times and that the user must erase any old index files.

USING THE PROGRAMS GENERATED BY AUTOCODE 1

The menu programs generated by Autocode 1 do everything exactly as they should. One fault is, however, noteworthy. Single quotes must be avoided in the title line and the option messages, since the generated code places the entries between single quotes. dBASE II treats single-quote pairs (' '), double-quote pairs (" "), and square bracket pairs ([ ]) as string delimiters. Autocode 1 should be sensitive to the presence of any of these and should use another delimiter.

The memory variable used by each menu program is generated from the file name of the program; hence menus can be nested with impunity. I would like to see the lines "SET BELL OFF' and "SET CONFIRM ON" included with each menu, but this is a matter of preference, and these lines are easy to include with a simple edit.

The file-maintenance program is certainly the most complicated program generated by Autocode 1, and it deserves attention because its performance is central to Autocode 1's usefulness. Again, the problem with text delimiters exists, and as a result, the example in the documentation doesn't display the entry screen correctly. The generated line

@ 1,31 SAY 'MARVIN'S'

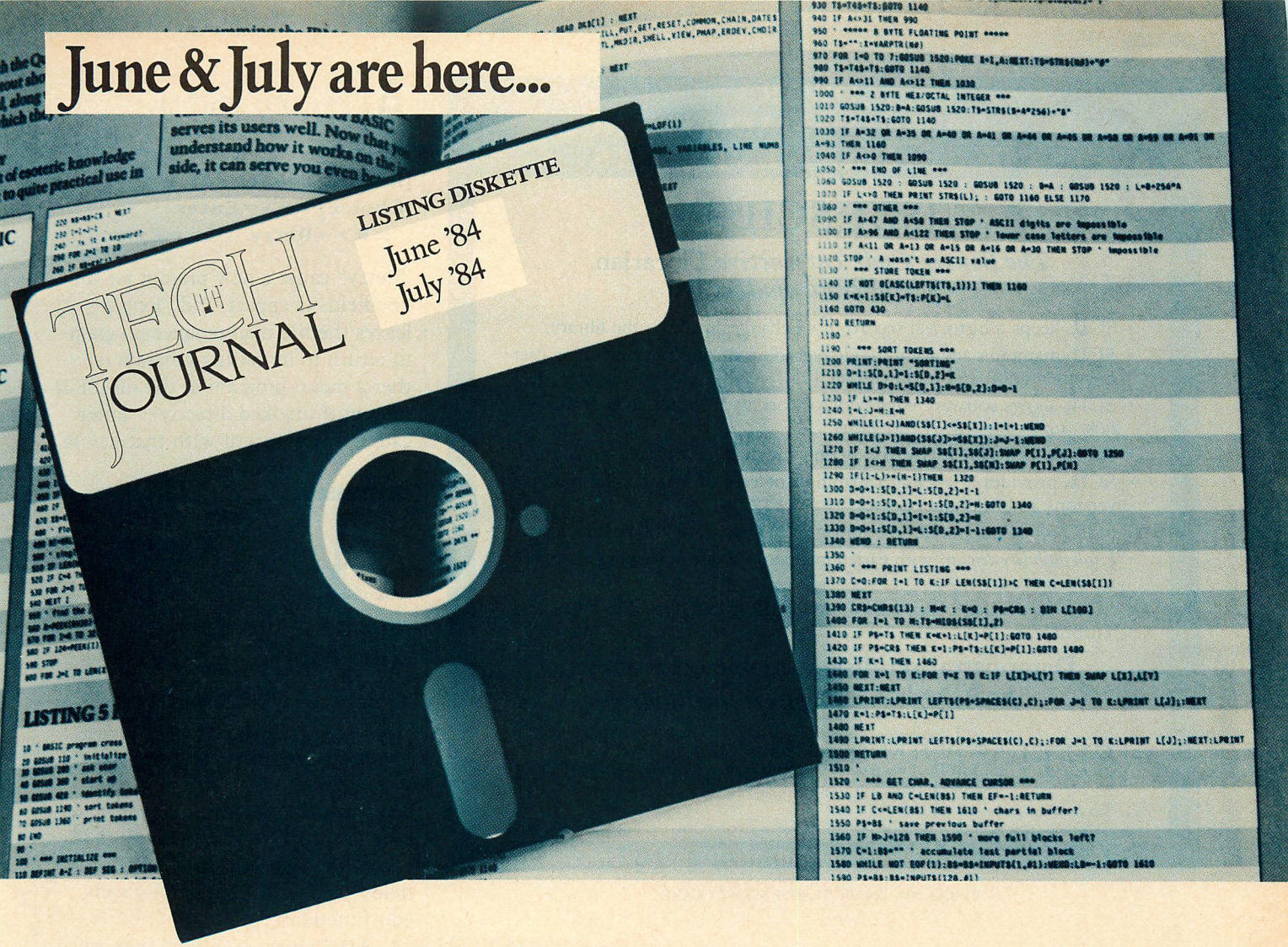
should read

@ 1,31 SAY "MARVIN'S"

or

@ 1,31 SAY [MARVIN'S]

When working with the file-maintenance program, the user is presented with the user-defined screen, with all data fields blank except the key fields. If, after values are entered for the key field(s), the desired record is not found, the bottom of the screen will read as follows:



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[Record Not Found]
[Choice] <E>=Enter
<R>=Retry <X>=Exit : :

"Retry" cause a new prompt for the key fields to appear, and "Exit" leaves the file maintenance program to return to its calling program (either a menu program or the dBASE II prompt if invoked directly). "Enter" causes a new record with that key to be appended onto the data base. The user can then enter data for all fields, except the key fields and calculated fields, using dBASE II's full-screen edit functions.

After entry, each field is checked with the range checks. If there are any invalid fields, those fields are re-edited, again with the full-screen edit.

After entry, each field is checked with the range checks. If any fields are not valid, those (and only those) fields are re-edited, again with the full-screen edit. Unfortunately, the cursor simply goes back to the offending fields with no error messages or explanation. After the user's entries have passed all range checks, any calculated fields are derived, then the "Continue/Exit" prompt appears:

[Choice] <C>=Continue
<X>=Exit : :

"Continue" causes a new prompt for the key fields to appear, whereas "Exit" performs as above.

When a record is found that matches the key fields entered, all fields on the screen are filled with the record's values and the screen prompt reads:

[Record Found]
[Choice] <A>=Amend
<D>=Delete <C>=Continue
<X>=Exit : :

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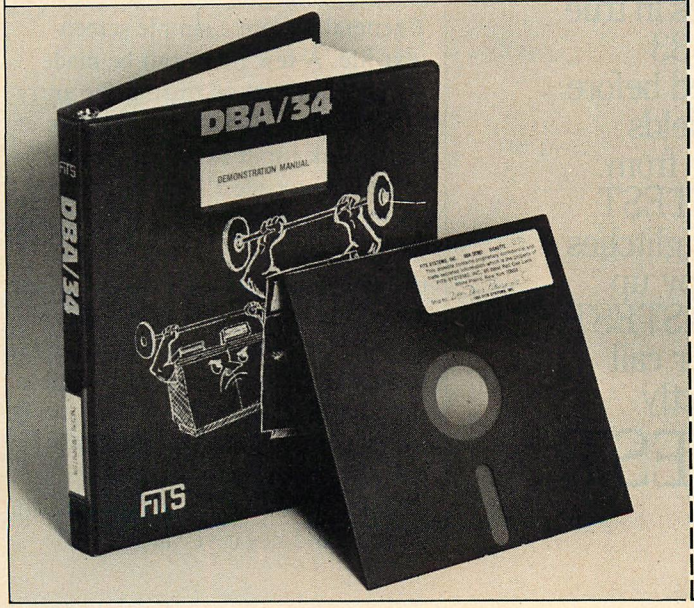
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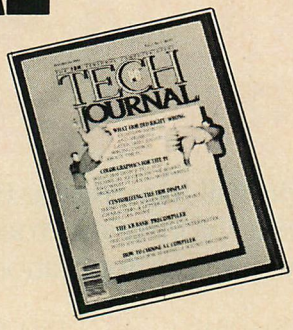
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AUTOCODE 1

"Amend" allows the record to be edited in a similar way as is used by the "Enter" function. All fields except the key and calculated fields can be edited using dBASE II's full-screen edit functions. Again, after editing, each field is checked with the range checks and re-edited if necessary. Following this, calculated fields are derived, and, finally the "Continue/Exit" screen prompt appears.

"Delete" causes the record to be marked for deletion. This will omit it from reports, but the Autocode 1-generated programs have no provision for actually discarding records marked for deletion for the data base. The dBASE II command "PACK" causes this deletion to take place.

"Continue" and "Exit" perform as above. When a record is marked for deletion, then subsequently found with a key match, all fields on the screen are filled with the record's values and the screen prompt reads:

```
[Record Deleted]
[Choice] <V>=Revive
  <R>=Retry <X>=Exit : :
```

"Revive" removes the delete mark from the record and the program enters the full-screen edit, as in the "Amend" mode above. "Retry" and "Exit" perform as indicated in the discussion above.

These actions describe the sophistication and functions performed by the dBASE II program that Autocode 1 generates from a simple screen text file. A few notes can be made about what goes on during the entry processing. If range checking is in effect, blank input fields are not accepted. Autocode 1's automatic date checking, however, does allow blank fields. Once again, dates appear on the screen as "MM/DD/YY" format, are edited with a "99/99/99" PICTURE (the only "picture" clause Autocode 1 generates), and are stored in the files as YYMMDD so they can be sorted correctly. Numeric calculations, for both the displays and the calculated data fields, are rounded for positive and negative values.

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No range check is performed on calculated fields, and trying to store '999' or '−10' in a two digit field results in '**' going into the file, as is normal dBASE II practice.

USING AUTOCODE 1: A FEW CRITICISMS

Autocode 1 has fairly modest goals as a program, and it achieves them well, but it is a frustrating program to work with. Some of the frustrations are related to design problems, and others are conceptual shortcomings.

Let's describe two hypothetical users of Autocode 1 to illustrate these contrasts. Imagine Joan Programmer. Joan is an accomplished dBASE II language user. She knows dBASE II, and she sets things out on paper before she starts a new project. Joan views Autocode 1 as a programmer's tool, and she uses it to save valuable time, since it generates sound code that is easy for her to modify to meet different needs. Joan is happy with Autocode 1 and finds no fault in it.

Autocode 1 has fairly modest goals, and it achieves them well, but it is a frustrating program to use.

Now imagine Sam Supervisor. He has dBASE II and Autocode 1 because the company programmer, Joan, recommended them for his department's use. Sam works things out as he goes along, since his word processing and spread sheet programs allow that. Sam is not a programmer, but he uses the computer frequently with WordStar to prepare documents.

For the life of him, Sam can't figure out the dBASE II "MODIFY COMMAND" function, so he uses WordStar to create his screen files for Autocode 1. He also occasionally forgets to use WordStar's nondocument mode, which causes Autocode 1 to act funny with his screen files.



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AUTOCODE 1

On top of that, Sam often forgets exactly what he named the screen files. Was it INVENTRY.SCR or INVENTOR.SCR for his inventory file? Because Autocode 1 displays no directory—not even a list of .SCR files—Sam frequently has to reset the system at the Autocode 1 prompt, "ENTER PRIMARY NAME OF SCREEN FILE." There is no Escape or Control-U to abort an Autocode 1 function once it is started.

Sam also forgets to print the initial file listing on the printer, so he gets confused about the field numbers. When he makes mistakes entering the formulas or minimum/maximum values, he's always amazed that "Restart" erases everything on the screen and he has to start over again. Poor Sam enters file names in lower case, and Autocode 1 erases his entry and prompts again when he presses RETURN.

He also forgets to enter a drive designator for the reports and isn't sure what to do when Autocode 1 later displays the "Bad file number in line 3600" message. Also confusing to him is that he has to enter the screen file name over again for each report he generates when he does several at a time. And there are the mysterious .KDT files that appear in his directory. Can he erase them?

Last week Sam moved one application from drive A: to drive C: on his hard disk. And he's sort of used to changing the "A:INVENTOR" to "C:INVENTOR" when dBASE II reports the "FILE NOT FOUND", "CORRECT AND RETRY (Y/N)" messages, now that he's figured out how to use the dBASE II command editor. But what has Sam really annoyed is that he redid the inventory screen to make the inventory location field larger by one place, only to find that the 426 records he had entered over the last two weeks were suddenly gone. When he started to reenter them, dBASE II acted funny, saying "RECORD OUT OF RANGE" when he went to update the new inventory locations.



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Finally Joan scolded Sam for not deleting the INVENTOR.NDX file, whatever that was, when he changed the inventory screen. Sam thinks dBASE II is unreliable, and he is afraid to use Autocode 1, since he lost so much time before the inventory.

Sam's difficulties illustrate the kinds of problems users might have using Autocode 1. I define the ubiquitous term *user friendly* as "easier to do using the computer than not." Autocode 1 is not very user friendly.

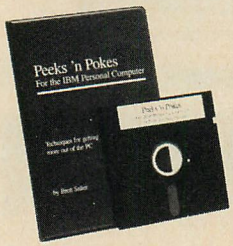
Autocode 1's overall design has one major conceptual shortcoming: it is designed with the idea that all work is new. It has no provision that allows the user to save what he has done and to revise that work later. I've mentioned its poor handling of the user's file selection elsewhere—the program offers no directory, no lower-case conversion, no way to abort a function to try it later, and no warning that the user has entered the name of a file that already exists and that will be silently deleted.

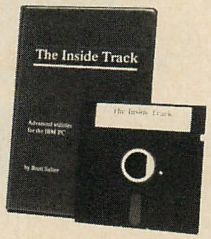
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When using Autocode 1, the user *must* print the detailed summaries that Autocode 1 creates, because they are his only record of what he's told it to do. And he won't be able to revise that work later. To change the range check on one field from "> 75" to "=> 75" he must regenerate the entire file-maintenance program, unless he knows both how to edit the generated program directly and what to change. Should the user edit the generated program, the detailed Autocode 1 summary no longer documents his working system.

It's also important to note that making changes to the dBASE II report forms is not a trivial task. The programmer must thoroughly understand the dBASE II report function's internal logic. Changing a "Y" to an "N" may require the addition or deletion of subsequent lines.

There is also no coherence between Autocode 1's functions. As related in my description of Sam Supervisor's experiences, the name of the screen input file must be entered for each report. And for each report, Autocode 1 analyzes the screen input file as if it were new.

To Joan, the programmer, this is flexibility—the user can work on several unrelated applications in one session. To Sam, the supervisor, this is confusion—for some reason, he has to respond to the same question over and over with the same answer even when working on one application. Even changing his mind while using Autocode 1 is hard, since the current screen is usually blanked out when the "Amend" option is selected. I appreciated dBASE II's full-screen edit functions even more when using Autocode 1, which has none.

It's true that it could be argued that most screens can be filled in quickly. That objection misses the point. Most programs used on a microcomputer allow users to edit their work. Rekeying data, no matter how small the quantity, does not match most users' expectations of how programs should be used.

The user doesn't change his mind when using Autocode 1; he starts over from the beginning. Once committed to a course of action, he must carry it through to completion or reset the system.

Conclusions

Although Autocode 1 has a modest cost of under $200, when that is included with the cost of dBASE II, an Autocode 1 system represents a list price investment of about $900. The potential purchaser should consider once again the criteria I mentioned: his need for repetitive program generation, how complex his needs are, and his programming skills.

Rekeying data, no matter how small the quantity, does not match most users' expectations of how programs should be used.

Anyone who does not intend to modify the Autocode 1 generated programs or to have someone else modify them will find an Autocode 1/dBASE II investment a poor value. For someone who is not made anxious by the prospect of modifying programs generated by Autocode 1 and who wants to get a "running start" on programming dBASE II applications, Autocode 1 might be a good investment.

Autocode 1 is particularly appropriate for those who frequently create new files and want to maintain and report them in relatively simple ways. For those who create new applications infrequently, Autocode 1 may ultimately be of little use.

The thought of writing even a simple application that only maintains and reports a file makes some people anxious; this may be a product for such people. Anyone who has a good command of the dBASE II language should be able to produce a more suitable application program than can Autocode 1. As a standalone program generator, Autocode 1 reduces dBASE II to a simple file manager. When modified by experienced programmers, however, Autocode 1-generated programs can approach the sophisticated systems for which dBASE II has built its reputation as a relational data base manager.

Carefully weigh the strengths and weaknesses of Autocode I as discussed here, then compare Autocode 1 to other dBASE II program generators. Autocode 1's low cost and simplicity may prove attractive.

Autocode 1
Written by Stemmos, Ltd.
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Editor's Note:
After this review was written, an enhanced version of Autocode 1 was released. Autocode Plus, which is available for $229 separately or $60 as an upgrade to Autocode 1, contains three new features: Search & Find, The Reporter, and Mailit.

Search & Find allows searching and sorting of the data base on any field, even if that field has not been designated as a key. The Reporter generates custom reports useful for filling in standard forms or for creating a form letter. Mailit creates custom mailing labels with up to four labels printed across the page.

Avoiding "Redo From Start" Problems

TECH NOTEBOOK 19

A program to handle string input without the problems caused by BASICA's "Redo from Start"

JEFF DUNTEMANN

IBM's BASICA is a magnificent creature; it goes about as far as anyone could take an implementation of BASIC. Its humble and ancient origins (1975: Microsoft's BASIC 80) are revealed, however, by its retention of some old-time features that, on a machine like the PC, have become bugs.

Certainly the worst of these is "Redo from start." If the user executes a line like

```
INPUT I%
```

and attempts to type string data into variable I%, BASICA will print the cryptic message "Redo from start" and wait for more input. This error cannot be trapped for using ON ERROR; the user must submit and type acceptable data.

The problem with "Redo from start" is that it will overwrite anything that happens to fall beneath it on the screen. Worse, if the INPUT statement is LOCATEd on lines 24 or 25 of the screen, the screen will scroll, taking with it the user's carefully constructed screen form.

The solution? Forget INPUT entirely and write another string input handler. Want to input numbers? Input them as strings, then use the VAL function to extract the numeric value from the input string.

Listing 1 gives a BASICA routine that will do the sort of string input acceptable for tightly designed full-screen form layouts. Not only does it eliminate "Redo from start", it also limits the length of the string to a preset size, preventing the user from accidentally tromping the adjacent field on his screen form.

Line 1040 of the demo program shows how the routine is invoked. The user passes it a maximum length value (LMAX%), a screen X,Y for the start of the string (FX% & FY%), and a "start with" string (OLD$). When invoked, the routine draws a field of length LMAX% in periods, bounded by a pair of vertical bar characters. If OLD$ has any text in it, the text is truncated to LMAX% or fewer characters and displayed left-justified in the field. An underscore "_" is printed to the right of the text as a cursor. For example, a field of length 10 and OLD$="Fire!" would appear on the screen as

|Fire!_. . . . |

The INKEY$ function captures key presses from the keyboard and guards against improper entry. The user can backspace over existing text, clear the field with CANcel (CTRL-X), or exit the routine with Return or ESCape; all other nonprintable control characters are rejected.

Pressing Return returns control to the calling logic with the entered string in variable X$. If the user exits the routine by pressing ESCape, a boolean flag variable ESCAPE will be set to 1. This will allow the calling logic to back out gracefully from an aborted field entry.

Ultimately, Microsoft may excise "Redo from start" from its otherwise excellent BASICA. Until then use Get String to prompt for text input.

Jeff Duntemann is a programmer for Xerox Corporation in Rochester, New York. His first book, Pascal from Square One, *will be published next January.*

Listing 1 GETSTRNG.BAS

```
1000  'Test program for Get String subroutine
1001  '
1020  SCREEN 0:WIDTH 40:CLS
1040  LMAX%=10:FX%=15:FY%=10:OLD$="foo":GOSUB 6200
1050  CLS:IF ESCAPE=1 THEN PRINT">>Text entry aborted...":END
1060  PRINT">>Text entered was: ";X$:END
1998  '
1999  '
6200  '>>>>>Subroutine: Get String
6201  '
6210  K%=0:X$="":Z$=""                              'Init variables
6215  IF LEN(OLD$)>LMAX% THEN OLD$=LEFT$(OLD$,LMAX%)'Truncate old text
6220  X$=OLD$:C%=LEN(X$)+1:QX%=FX%+C%               'Set length counter
6225  LOCATE FY%,FX%,0:PRINT"|";OLD$;STRING$(LMAX%-LEN(OLD$),46);"|";
6230  LOCATE FY%,QX%:PRINT"_";
6235  WHILE (K%<>13) AND (K%<>27)            'While not (ESC) or (CR)
6238    Z$="":WHILE LEN(Z$)=0:Z$=INKEY$:WEND 'Wait for character
6240    K%=ASC(Z$)                           'Get ASCII code equivalent
6242    IF K%<>24 THEN 6250                  'CANcel handler follows:
6245    X$="":C%=1:LOCATE FY%,FX%+1:PRINT STRING$(LMAX%,46)
6247    LOCATE FY%,FX%+1,1:PRINT"_";:GOTO 6280
6250    IF K%<>8 THEN 6260                   'Backspace handler follows:
6252    IF C%=1 THEN SOUND 50,4:GOTO 6280    'If field is empty, honk
6254    IF C%<=LMAX% THEN LOCATE FY%,FX%+C%:PRINT".";
6255    C%=C%-1:LOCATE FY%,FX%+C%:PRINT"_";:LOCATE FY%,FX%+C%
6257    IF C%=1 THEN X$="": ELSE X$=LEFT$(X$,C%-1)
6258    GOTO 6280
6260    IF (K%=13) OR (K%=27) THEN 6280            '(ESC) or (CR)
6265    IF (K%<32) OR (K%>126) THEN SOUND 50,4:GOTO 6280 'Printable?
6270    IF C%>LMAX% THEN SOUND 50,4:GOTO 6280      'String is at max size
6272    LOCATE FY%,FX%+C%:PRINT Z$;:C%=C%+1        'Display new char.
6275    IF C%<=LMAX% THEN LOCATE FY%,FX%+C%:PRINT"_";
6278    X$=X$+Z$                                   'Append new character to X$
6280  WEND
6285  IF K%=27 THEN ESCAPE=1:ELSE ESCAPE=0    'Set escape flag if apropos
6290  RETURN
6299  '
```

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MICHAEL OLFE

dBASE II with AMBITION

Three screen/report writers for dBASE II command files

Given the great commercial success of dBASE II, what can be done about its built-in shortcomings? It has a primitive editor, a crude report generator, and only the beginnings of a forms-generation capability. For an author developing dBASE II applications, these are major hurdles. A user has only to create a crowded input screen for the first time using a paper, pencil, and @ x,y SAY statements to appreciate how time-consuming this process can be, particularly since dBASE II has no compunctions about overwriting some fields with others if the user mistakenly tells it to do so.

Different people take different approaches to the problem. Some write editor or keystroke macros to insert "@ x,y SAY" statements in CMD files they are building. Others take a more ambitious approach and write real screen/report designers that allow you to "paint" the screen, then transform your screen into a "CMD" or "FMT" file which can become part of a larger program. The three products reviewed here are of the "ambitious" type. SED, MAPGEN, and EZdBASE all generate input/output screens for use with dBASE II command files. Each goes about this task in a different way, and some do much more besides.

SED FROM ASHTON-Tate

Ashton-Tate has been including a screen/report generator called ZIP with its CP/M versions of dBASE II for more than a year. SED (Screen Editor) is the IBM PC and MS DOS analog of ZIP, written by different authors and superior to ZIP in most ways. SED is a full-screen, general-purpose editor and dBASE II screen/report designer. Considering that SED is included free with IBM-PC versions of dBASE II, the obvious question to ask is why buy something else. In most cases, there is no reason to—SED is completely adequate for many needs. But, because there are a few jobs SED doesn't do or doesn't do as well as MAPGEN and EZdBASE, some people may find one of the latter products more useful.

SED's main menu presents a picture of the main parts of the program and a prompt asking for a choice:

1. Read on-line documentation
2. Edit a new file (a screen definition file or any other file)
3. Edit an old file
4. Resume editing the current file
5. Generate code from a screen definition file
6. Quit

SED's most impressive feature is undoubtedly its on-line documentation, which not only includes an index, table of contents, and appendices but is page-numbered and goes on for

Michael Olfe is a microcomputer project specialist with General Electric Information Services. Formerly, he was new products director at Lifeboat Associates.

almost 40 full-screen pages. At any point during a quest for information, it is possible to go directly to the relevant page. The documentation is tied to a help key, which is completely context-sensitive. If the second key of a two-key command is forgotten during screen reconstruction, pressing the help key will give the needed information. Forgot the whole command? A press of the help key will show the table of contents, from which to navigate to the correct page with one or two more keystrokes.

When I first saw the five pages of printed documentation supplied with SED, I was skeptical. Now, I'm a believer. The SED on-line documentation makes printed documentation unnecessary. It's complete, concise, includes plenty of examples, and is completely adequate for everyday and reference use. But is it fast? Yes, faster than turning pages. The only disappointment was being able to list only one screenful of the documentation to the printer at a time. For those of us with an irrational attachment to paper, it would be helpful to be able to print out all the documentation with one keystroke.

Some other unique features of SED increase its appeal. Its editor is much better than the one built into dBASE II or the other products mentioned here. Not only does it have a larger repertoire of useful commands, but unlike the EZdBASE or MAPGEN editors, it edits ASCII text files without inserting control characters into them. This means that it can be used to edit any DOS ASCII files, not just screen definition files.

The editor is also user-configurable for different terminals and different command keys, so that it can be customized to resemble another editor. Some of the more advanced commands provided in the SED editor are line and word delete, cursor movement by page, block move/copy/delete, find/replace, horizontal scroll, and line and box-drawing.

Among the products reviewed here, SED is the only one that can also generate reports, because it is the only product that can handle screens wider than 80 columns and longer than 24 lines. Since an 8 ½ x 11 inch piece of paper has 66 lines, even a simple report format will require at least that many lines. SED can handle report definitions up to 40,960/maximum-column-width+1 lines long. Thus, a 256-column report could be, at most, 159 lines long.

Of course, nothing is perfect, and the SED editor is no exception. I got the impression that SED is not quite finished, and perhaps by the time you read this, many of these minor problems will have been fixed.

- SED does not handle DOS 2.0 path names, which limits its usefulness on the PC/XT.
- The edited file cannot be more than 505 lines or 40K characters, whichever comes first. This is not a problem, just a limitation.
- A carriage return is inserted in both insert and overwrite modes, rather than only in insert mode.
- During input of file names, the edit keys active throughout the program (DEL, HOME, END, and the arrow keys) suddenly become graphics-character generators instead of edit keys, a behavior that is not documented anywhere and that certainly must be a bug.
- The function keys generate graphics characters, a feature that is also not documented.
- The box-drawing routines use "¦" and "-" characters to draw lines and boxes, rather than the more attractive graphics characters. SED should allow specification of characters used for this purpose.
- A bug in the find/replace command causes a return to DOS when you try to replace "¦" and "-" with graphics characters.
- The program sometimes forgets to erase the prompt line before changing it, so that the previous prompt appears in the input field.

When I first saw the five pages of documentation supplied with SED, I was skeptical. Now, I'm a believer. SED's on-line documentation makes printed documentation unneeded.

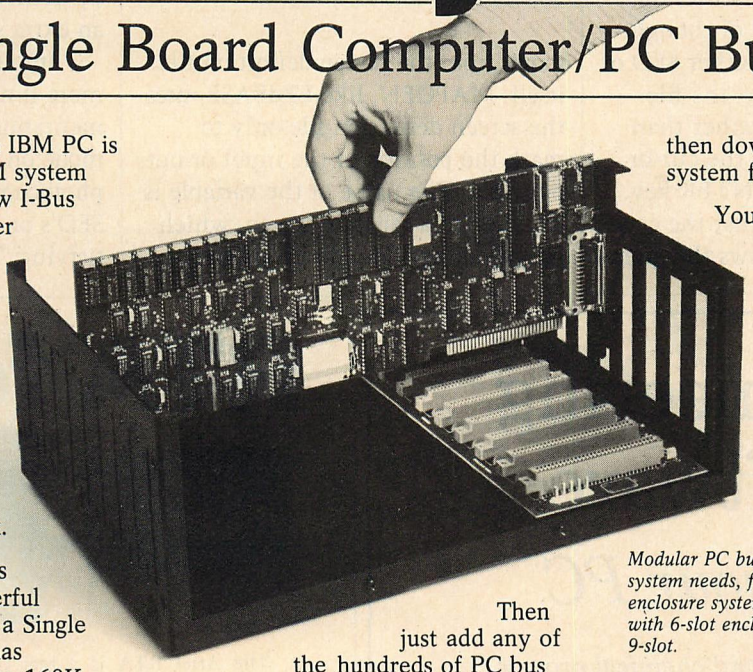
These are all minor annoyances compared to the next: SED does not have the option of putting the generated code in a file with one name and keeping the screen definition file under another name. Instead, it overwrites the screen definition file with the file containing generated code, making it impossible to go back to an old screen and edit it. As long as code isn't generated, the screen file is safe, and can be re-edited with SED as often as necessary. To preserve the screen for future editing, the screen definition must be saved under two different file names (SED gives a command to do this), one of the files must be reloaded, and finally code can be generated. This is a strange and annoying flaw in an otherwise very good product—a flaw shared by neither EZdBASE nor MAPGEN. Ashton-Tate says the problem will be fixed in the next version of SED.

One other problem with SED is a result of dBASE II. The straightforward scheme used by SED to support color and character highlighting is to do it through the ANSI.SYS driver included with DOS 2.0. ASCII character sequences embedded in the screen definition file are translated by SED into an ANSI escape sequence when the code file is generated. Unfortunately, dBASE II, like BASICA, doesn't pass these characters through to DOS via the standard DOS output calls, which means that character highlighting via this method just doesn't work. Ashton-Tate claims that this problem will be fixed by modifications to dBASE II itself in the next release. Of course, the standard character highlighting already supported by dBASE II works well.

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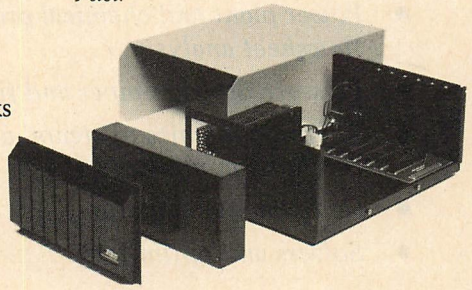
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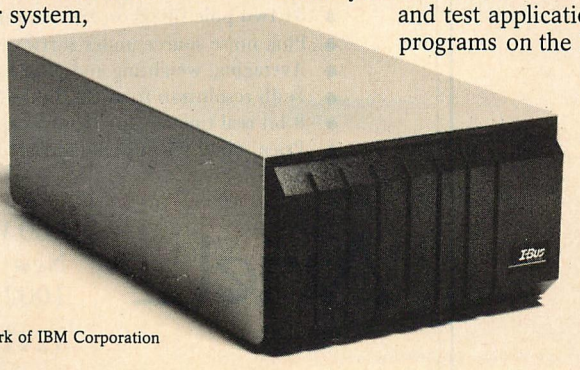
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MAP/GENERATOR FROM LAMBDA ASSOCIATES

MAPGEN is a screen/report generator that can generate dBASE II, Microsoft BASIC, or DOS 2.0 code files from the same screen-definition file. This multiple generation capability is the major advantage of MAPGEN. The generated BASIC code can be compiled with BASCOM, and the DOS 2.0 code can be used to generate DOS 2.0 menus by using a TYPE command in a BAT file.

The main MAPGEN menu options are Edit, Print, Generate, Quit, Directory of A, and Directory of B. Edit, Print, and Generate submenus give a list of all MAPGEN files on the logged-in disk—a bit of thoughtfulness not provided by either SED or EZdBASE. Unfortunately, the file name must be retyped, rather than simply found by placing the cursor over it and hitting the ENTER key. Another nice feature is that the code-generation submenu allows the queuing up of several files to be run through the code generator.

MAPGEN's code generation philosophy differs from that of SED, which takes the input or output field name from the screen-definition file itself. MAPGEN, like EZdBASE, uses the screen definition file only to mark the position of the input or output field. The name of the variable is supplied in a separate screen, which has advantages and disadvantages.

Magpen can generate dBASE II, Microsoft BASIC, or DOS 2.0 code files from the same screen definition file. This multiple generation capability is its major advantage.

On the one hand, it allows the changing of the field variable names independent of their placement on the screen. It's possible, for example, to take a dBASE II screen-definition file and add BASIC variable designators like "%" and "$" to the variable names, then generate a BASIC code file. Or the same basic screen layout can be used to generate multiple input screens with different variables. Unfortunately, this requires two steps rather than one: first, the positions and types of fields on the screens must be defined, and second, the variable names and field widths must be defined. Somewhat more flexibility is gained at the expense of an extra step in the screen definition.

In other respects MAPGEN is more limited than SED. The documentation, printed in compressed mode on a dot-matrix printer and photocopied, is as frustrating to use as SED's on-line documentation is satisfying. There were several passages

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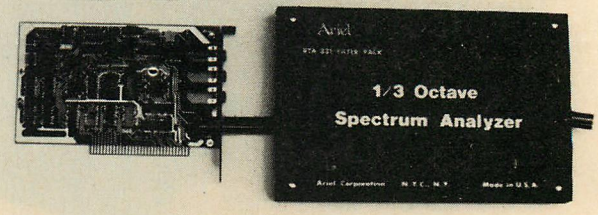
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that were unreadable without a magnifying glass, and even where the documentation was legible it was sometimes unclear or incomplete. The documentation is written for programmers, not for end-users.

The editor has some useful commands—e.g., centering, right/left line justification, and cursor positioning to first or last field—but because it embeds control characters in the text, it can only be used with MAPGEN-generated screen-definition files. The MAPGEN editor has other significant limitations:

- —it works only in overwrite mode; insertions require retyping.
- —it lacks commands to delete characters or lines.
- —highlighting is supported only in code generated for BASIC.

The MAPGEN editor does allow the insertion of graphics characters by using the ALT key and the numeric keypad. With the repeat-character-to-left and repeat-character-to right commands, lines and boxes can be drawn with some effort. However, the generated code cannot be edited with the dBASE II editor, which zeroes the eighth bit in every byte.

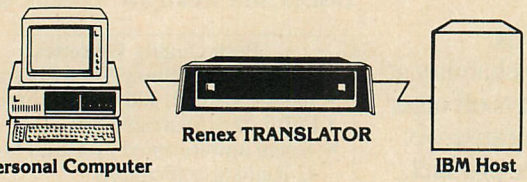
MAPGEN also has one minor and one major bug. A minor bug, so-called only because it is so easily fixed, is the unfriendly way MAPGEN has of returning to DOS if the user inputs a menu option input that is not displayed on the main menu. A major bug that can result in the loss of a screen definition is a set of screen definitions that can hang the program. If a one-character field is defined in front of another field, MAPGEN will hang up at the field length definition phase. It prevents the entering of a field length greater than one or equal to zero, which is fine. But it also prevents the entering of a field length equal to one. The effect of this is that *no* field length is acceptable to the program, and users are stuck in an infinite loop, with no recovery possible except a warm boot.

EZdBASE FROM AUTOMATED OFFICE SYSTEMS

This product is oriented towards the unsophisticated end-user *of dBASE II.* Cuteness abounds, from the trills that serve as error warnings to the smiling faces used for field markers. Beyond the cloying user interface, EZdBASE can be a useful tool. Its documentation is wordy, but complete. The on-line help is minimal, but because EZdBASE only tries to do a few things, the size of on-line documentation is appropriate to the minimal functionality of the program. The editor has useful commands—e.g., line/character insert and delete, line centering, and line copy—but, like MAPGEN, embeds control characters into the text, limiting its use to editing EZdBASE screen files. EZdBASE can handle only one 80-column by 24-line screen at a time.

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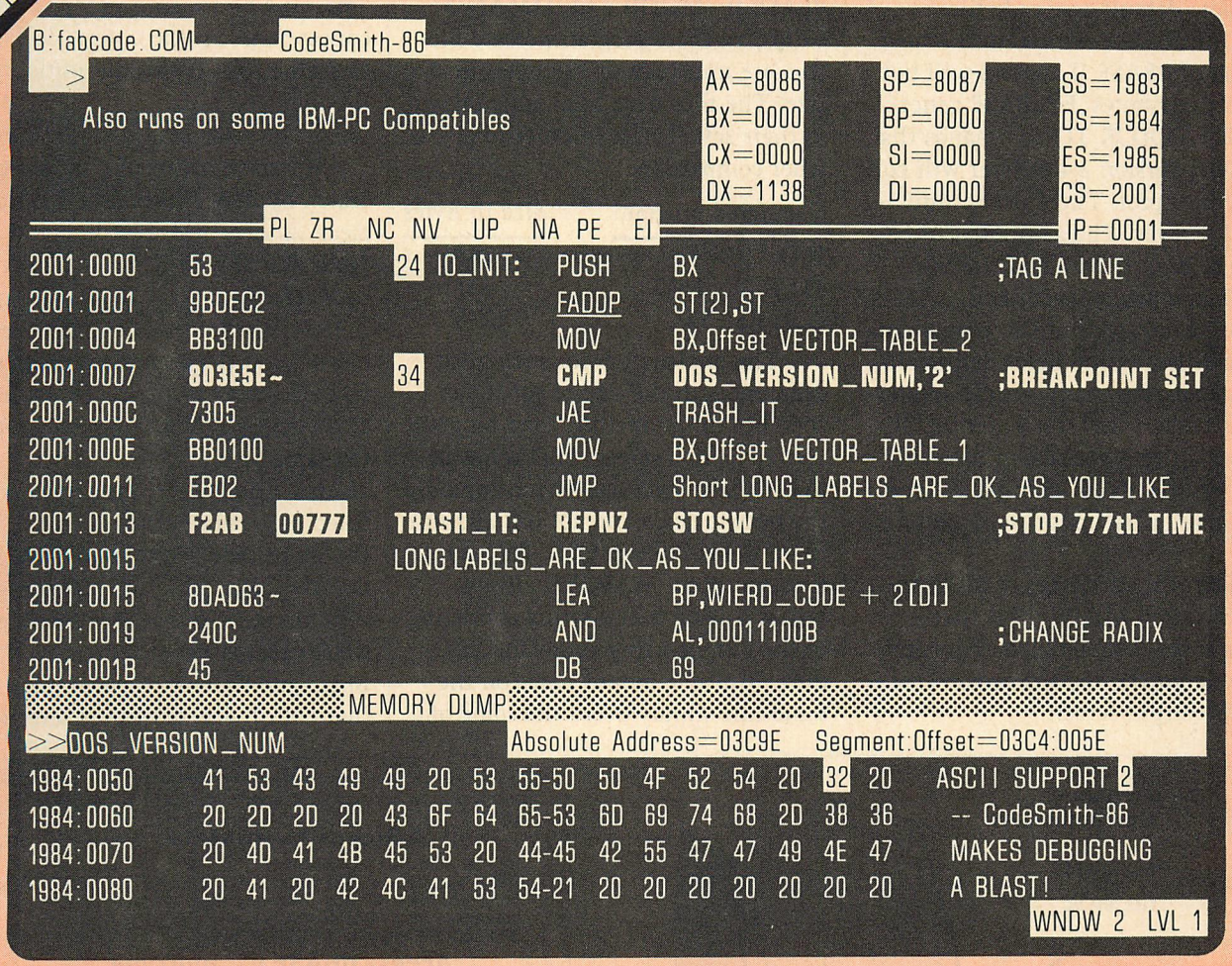
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than any of the other products reviewed here: character attributes, DBF generation, and generation of a complete default-case code file.

Unlike SED, which until a new version of dBASE II appears will not support attributes, EZdBASE generates SET COLOR TO commands that dBASE II version 2.4 or later will correctly interpret. There is one limitation, however. The attribute can be set or reset only for an entire line.

Once a screen is defined, EZdBASE can generate an empty data base containing the fields defined in that screen. For many simple applications, this is a real convenience. Of course, if the input screen uses only some of the fields defined in the data base, this option will be of no use.

The real advantage of EZdBASE over SED and MAPGEN is that it does a more complete job of generating code for the most common case—a simple input screen.

THE SIZE IN BYTES OF GENERATED PROGRAM CODE

To maintain compatibility with the dBASE II "MODIFY COMMAND" editor, all these programs create files that are multiples of 128 bytes in size. The files have been edited down to their actual sizes in order to give a truer comparison.

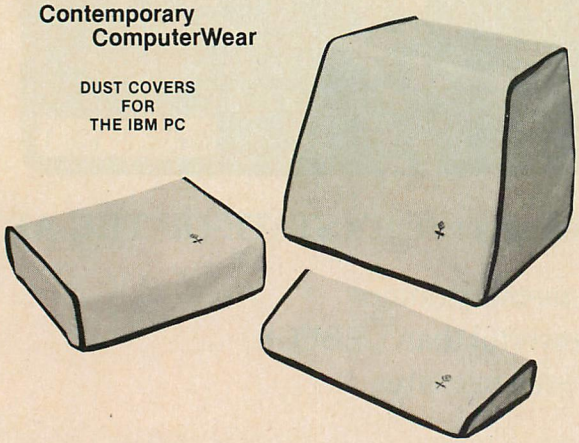
Generated program	Size in Bytes
SED	283
MAPGEN FMT	531
EZdBASE PRG	1278

The explanation for such great differences in the size of generated code lies in the method each program uses to paint a screen. SED achieves the smallest code size by writing *only* the output fields and not initializing them to blank by default. For each line of output, MAPGEN always writes a 40-character string consisting of the output string and blank padding. Multiple output fields on the same line simply overwrite some of the blank padding in the original output field. EZdBASE takes a similar approach, but instead of using one "@x,y SAY" for each output field, it concatenates all the output fields on the same line. It also can initialize the memory variables to blank at the top of the command file.

A partial listing of the code generated by each program makes this clear, as seen in figures 1, 2, and 3. Note that SED achieves a smaller code size by making some assumptions—i.e., that the screen has been cleared and the memory variables initialized before using the SED-generated command file. MAPGEN makes the same assumptions, but because it always writes 40-character, blank-filled input prompts, will insure that the input field is cleared. EZdBASE doesn't make these assumptions—it assumes instead that there is no particular reason to want the TALK, BELL, and COLON flags on, and sets them off. It also erases the screen,

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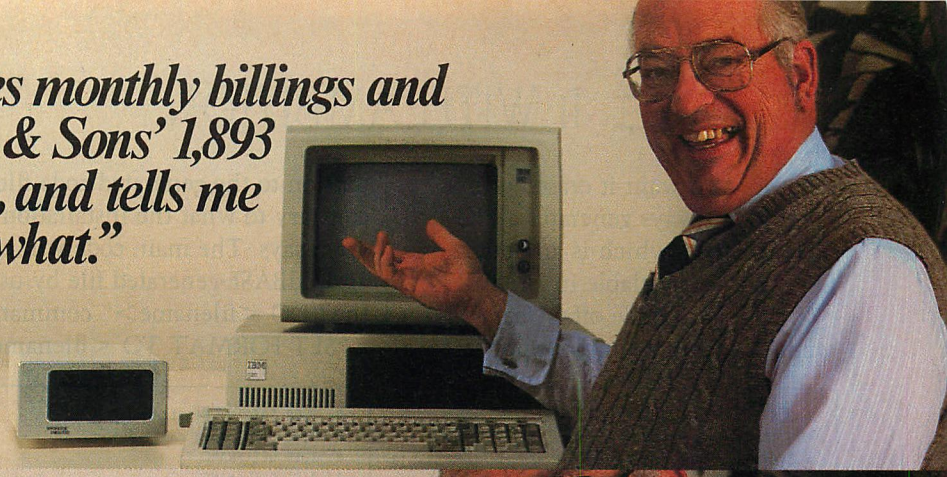
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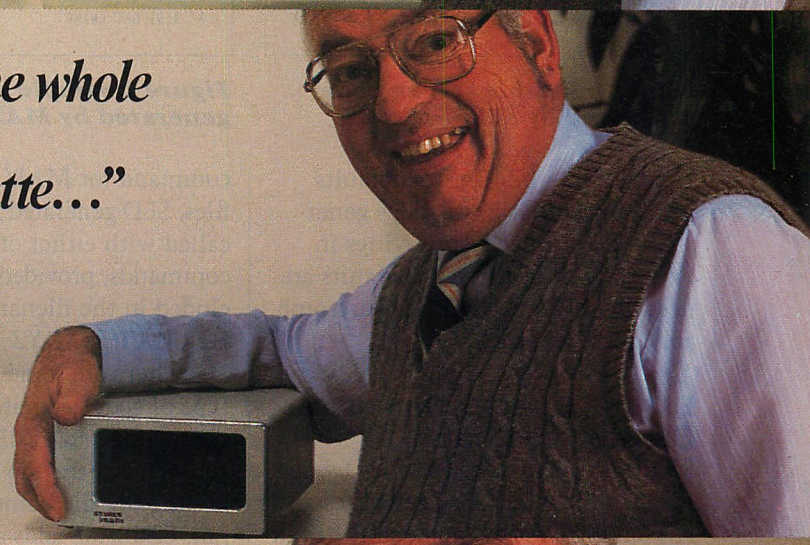
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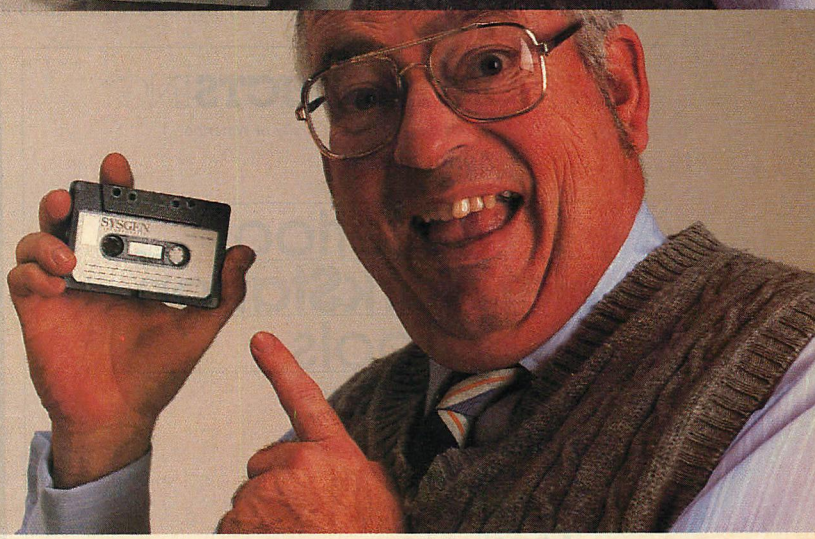
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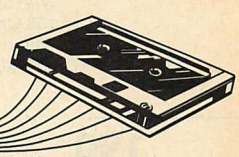
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whether you want it erased or not. Finally, it always generates a PICTURE clause, which is an option in SED and not available in MAPGEN.

There are trade offs. Users who want to generate simple input screens and who like EZdBASE's defaults won't mind that EZdBASE's generated code is longer. For savings in disk space or if different defaults are needed, SED and MAPGEN are probably better choices.

```
@ 2,6 SAY "first name"
@ 2,18 GET fname
@ 2,44 SAY "last name"
@ 2,55 GET lname
```

Figure 1: Sample screen code generated by SED

```
@  3,00 SAY '   first name
@  3,40 SAY ' last name
@  3,15 GET FNAME
@  3,51 GET LNAME
```

Figure 2: Sample screen code generated by MAPGEN

Ease of Integration of the Generated Code

EZdBASE generates PRG files by default, while MAPGEN generates an FMT file. SED adds no default file extension to the generated code file, contrary to what the installation program says. The main code will call an EZdBASE-generated file by using the "DO <filename>" command or a "SET FORMAT TO <filename>" command for MAPGEN-generated files. SED-generated files can be called with either of these dBASE II commands, provided a period is included in the filename—"SET FORMAT TO XYZ," for example.

There are some differences in the type of code generated by each program. SED and EZdBASE generate a comment at the top of the file containing the file name; MAPGEN does not. EZdBASE adds a READ and RETURN at the end of the file; the others do not. It is a reasonable assumption that most of the time you'll want to "READ" the data just collected — EZdBASE does that for you.

Time To Generate Code

SED, written in Pascal, operates noticeably faster than MAPGEN or EZdBASE, which are compiled BASIC. However, execution speed is far less relevant to the speed of code generation (which all the products do quickly) than the number of steps involved in generating code. Here's a quick comparison:

SED
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MAPGEN
- design screen
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- compile

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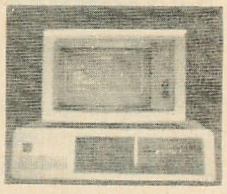
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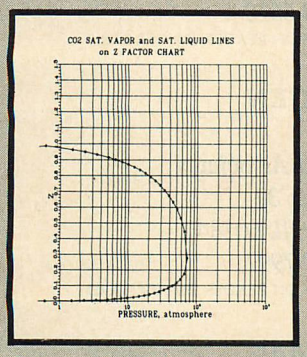
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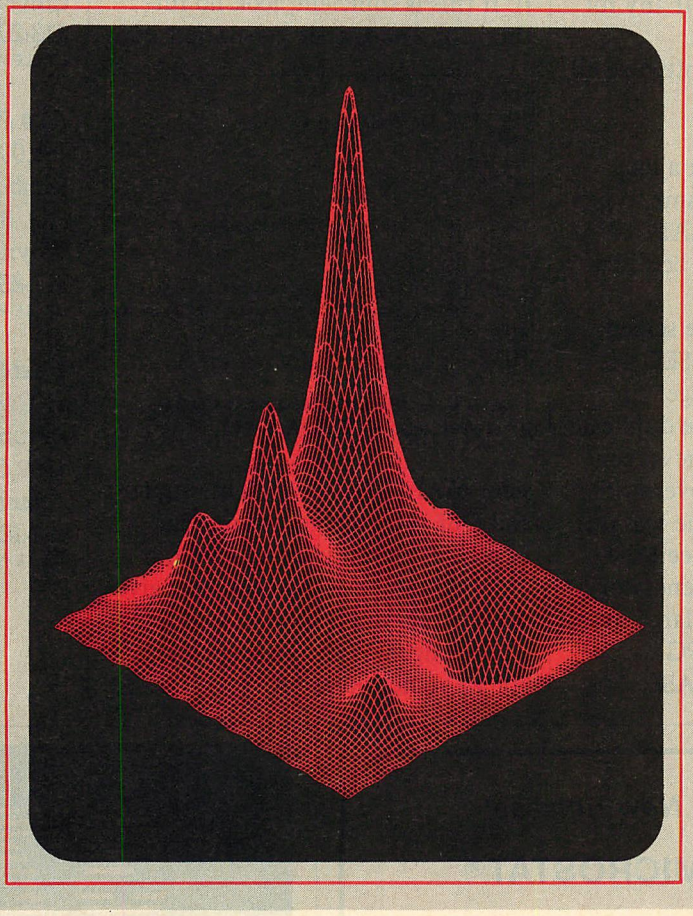
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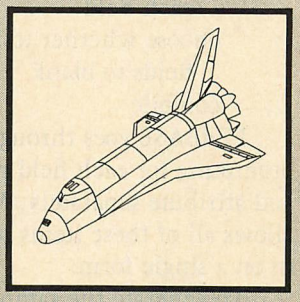


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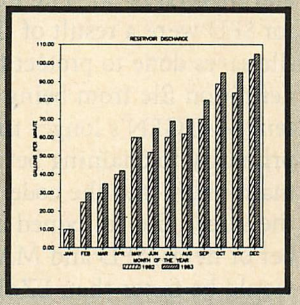


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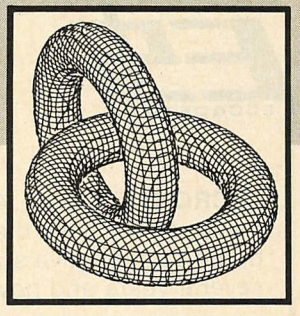




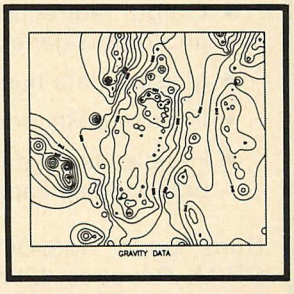
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EZdBASE

design screen
input field name for each field
input field type for each field
input attribute type if any for each field
choose whether to initialize all fields to blank
compile

EZdBASE goes through a loop prompting for each field name, type, and attribute separately. MAPGEN allows all of these items to be filled in on a single form.

To generate the sample screen, EZdBASE took 38 seconds, SED 41, and MAPGEN 50. The longer times for SED were a result of the duplicate file saves done to protect the screen definition file from being overwritten. MAPGEN's longer time was due primarily to chaining between the main menu and the code generator. If the screen file contained a large number of fields, SED and MAPGEN would be faster than EZdBASE.

WHICH IS BEST

SED has on-line documentation, a full-featured editor, handles report formats, and is included with dBASE II. If this is sufficient, look no further. For BASIC code generation, consider MAPGEN. For attribute support and DBF file generation, consider EZdBASE. If you want to state the problem and have the computer give the answer, you'll have to wait a while longer. We're getting closer, but we're not there yet.

```
SET TALK OFF
SET FORMAT TO SCREEN
ERASE
SET BELL OFF
SET COLON OFF
STORE "                " TO fname
STORE "                 " TO lname
@  3 ,0 SAY "       first name                ";
+ "    last name                          "
@  3 , 19  GET fname PICTURE "AAAAAAAAAAAAAAAA"
@  3 , 55  GET lname PICTURE "AAAAAAAAAAAAAAAAAAAA"
READ
RETURN
```

Figure 3: Sample screen code generated by EZdBASE

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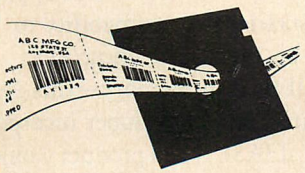
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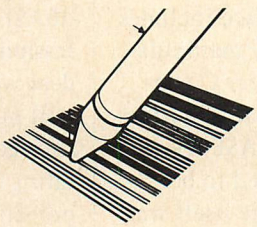
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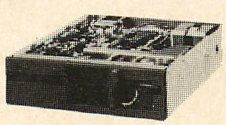
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dBASE II BECOMES C-Worthy

Subroutines for writing C programs that read and write dBASE II files

RICHARD M. FOARD

C to dBASE II, offered by Computer Innovations, Inc., is a package of C language subroutines with which a C programmer can write programs that read and write dBASE II files. It includes an extensive sample application program, which contains potentially re-usable subroutines for viewing and editing dBASE II files on a display terminal.

The $195 package has 78 C subroutines, provided on diskette in both source and relocatable forms. The package was developed under Computer Innovations' own C86 C compiler and run-time environment.

FUNCTION

The C to dBASE II interface includes a set of primitives for the manipulation of dBASE II files under C control. This is not to say that it is functionally equivalent to dBASE II—it isn't, and it isn't advertised to be.

The dBASE II package itself was undoubtedly implemented as a hierarchy of software layers. A bottom layer of basic file access routines allows positioning to, reading, and writing physical records in disk files. A second layer, which "knows" the name, type, and length of each record field (intelligence gained by reading a standard header that appears at the beginning of each dBASE II data file) frees still higher layers from having to know the byte-for-byte structure of disk records by allowing record fields to be addressed by name rather than by byte offset in a buffer. A third layer implements indexing, sorting, and dBASE II's relational Select and Join operations by calling upon the second and first layers, and the topmost layer presents the dBASE II interface to the user, with its command/programming language, query language, report composition facility, and formatted screen management for data entry and editing.

C to dBASE II provides, in C, the bottom two layers of basic data file and record field manipulation and a subset of the third-layer facilities for managing dBASE II index files. C to dBASE II's only severe limitation by professional standards is its inability to deal with an index file whose keys will not all fit into memory—this is a shortcoming that a developer incorporating C to dBASE II in a product would probably have to rectify through his own programming efforts.

COMPOSITION

The package consists of four C source modules: C2DBASE, TERMINAL, DBINDEX, and DBLIB. C2DBASE is a sample application program which, through menu-driven interaction with its user, allows the user to create, delete, list, search for, and edit records in a dBASE II file, optionally using a companion index file. Records may be displayed in index order or written to a disk file in either of two text formats, all under control of a simple menu of commands.

Richard Foard is vice president of software development for ROADNET Systems Corporation, formerly Travel Technology Corporation, a Baltimore-based company.

TERMINAL contains routines for performing operations on the display terminal such as clearing the screen, moving the cursor, and displaying messages; it isolates knowledge of terminal characteristics to make it easy for users to tailor the sample application for use with other terminals by replacing the routines in TERMINAL.

The real meat of C to dBASE II, the routines that understand the physical structure of dBASE II files and operate on them, is contained in the two large modules DBLIB and DBINDEX. DBLIB contains procedures that operate on basic dBASE II relations; DBINDEX carries the routines that operate on the index files.

Of the 78 routines that make up the interface, only about 30 are concerned with the business of opening, closing, reading, and writing dBASE II data and index files. The rest are either part of the sample application program C2DBASE or are supporting routines to the sample application. The equal treatment of all 78 routines in the documentation created a hurdle of confusion that this reviewer had to overcome before gaining a full understanding of the package. The document, while complete and reasonably clear as a reference, does its reader two disservices: it fails to provide any technical overview of the operation of the interface, and it makes no distinction between routines in the sample application program and those in the dBASE II interface proper.

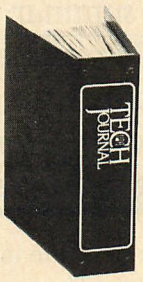
DOCUMENTATION

A quick look at the 94-page document accompanying the package would scare a programming novice silly. It provides a brief introduction that explains what the four basic program modules contain, advises that "the place to look to really figure out how the code works is the source itself," then continues with a 78-page (one page per routine) description modeled after standard UNIX subroutine reference documentation.

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In light of his documentation's contents, the author is wise to admonish readers to read the code in order to understand the package. Assembling an understanding of how to use the package by reading the calling sequence summaries of each of its 78 routines is much like coming to understand the proverbial forest by examining its leaves. Learning to use a piece of software by reading its source code isn't the easiest path to enlightenment either, but the package's sample application program does exercise all 78 subroutines, and is reasonably clear reading for an experienced C programmer.

INTERFACE DESIGN

In their excellent book, *Elements of Programming Style*, Kernigan and Plauger list a number of simply stated rules for programmers. Among them is this one: "Every subroutine should hide something." This rule may be paraphrased to apply to the design of good subroutine packages: A subroutine package should hide a significant portion of the complexity of the structures it manages from user (calling) programs. C to dBASE II obeys this rule. It relieves its user from the necessity of understanding such things as how the header of dBASE II data file is structured to contain a description of the name, type, and length of each field in the file. It makes it unnecessary for the user to know which MS-DOS (or other underlying operating system) file system operations must be performed to position to, read, or write a dBASE II record. It also provides functions that allow the calling program to remain ignorant of things it has no business knowing in the first place, such as the way dBASE II encodes floating point numbers.

In order to gain access to a dBASE II file, the C to dBASE II user must (1) call a routine that allocates a master data structure, (2) store the name of a dBASE II file (and, optionally, the name of an index file) into the structure, and (3) call a routine to "open" the file and prepare the master data structure for use. Once it has opened a file, the calling program makes all subsequent references to the file by passing a pointer to the master data structure as a subroutine parameter.

If a file is opened successfully, C to dBASE II reads its dBASE II header information and stores away a description of the record structure in the master data structure. The master data structure also contains a record image in the form of a set of C substructures, which contain the description of each record field and the value of the field in the "current" (most recently read or composed) record. The number of master data structures that may be simultaneously in use is limited only by memory size, allowing callers to open and operate on many files at the same time.

Assembling an understanding of how to use the package by reading the calling sequence summaries of each of its 78 routines is much like coming to understand the proverbial forest by examining its leaves.

A simple sequence of calls to C to dBASE II might look like figure 1 (parameters omitted).

The interface is clean and relatively consistent, raising only a slight possibility for confusion by accepting some information from the calling program in subroutine parameters but requiring that other information be passed to and from the package by looking or storing directly into a file's master data structure. An object-oriented interface designer would insist that the composition of the master data structure be known only to the subroutine package, and would require that the calling program always fetch and store information about a file by making calls to a well-defined set of primitive subroutines.

A quibbling critic would wonder why the package provides its callers with convenient opportunities to make errors such as that of forgetting to allocate a master data structure before opening a file, when the open routine could just as easily allocate the structure itself, removing the chance for a mistake. Nonetheless, the interface is a sound one, easily learned, and imposes no unreasonable limitations on calling programs.

UTILITY

C to dBASE II is a competent software package that delivers what it promises, however obscurely, in its documentation. The 30 subroutines that manipulate dBASE II data and index files provide a reasonable file management kernel to developers of C language applications intended for use in conjunction with dBASE II data bases and application programs (with the single exception of the restriction that a set of index keys must be able to fit into memory). Computer Innovations places no restriction on re-use of the package, modified or unmodified, in software for resale.

```
dalloc();               /* allocate a master control structure */

/* store a file name in the master control structure */

dopen();                /* open the file */
dposition();    /* position at a particular record */
dread();                /* read the record */

/* inspect and change the record's contents by operating
 * on the master data structure */

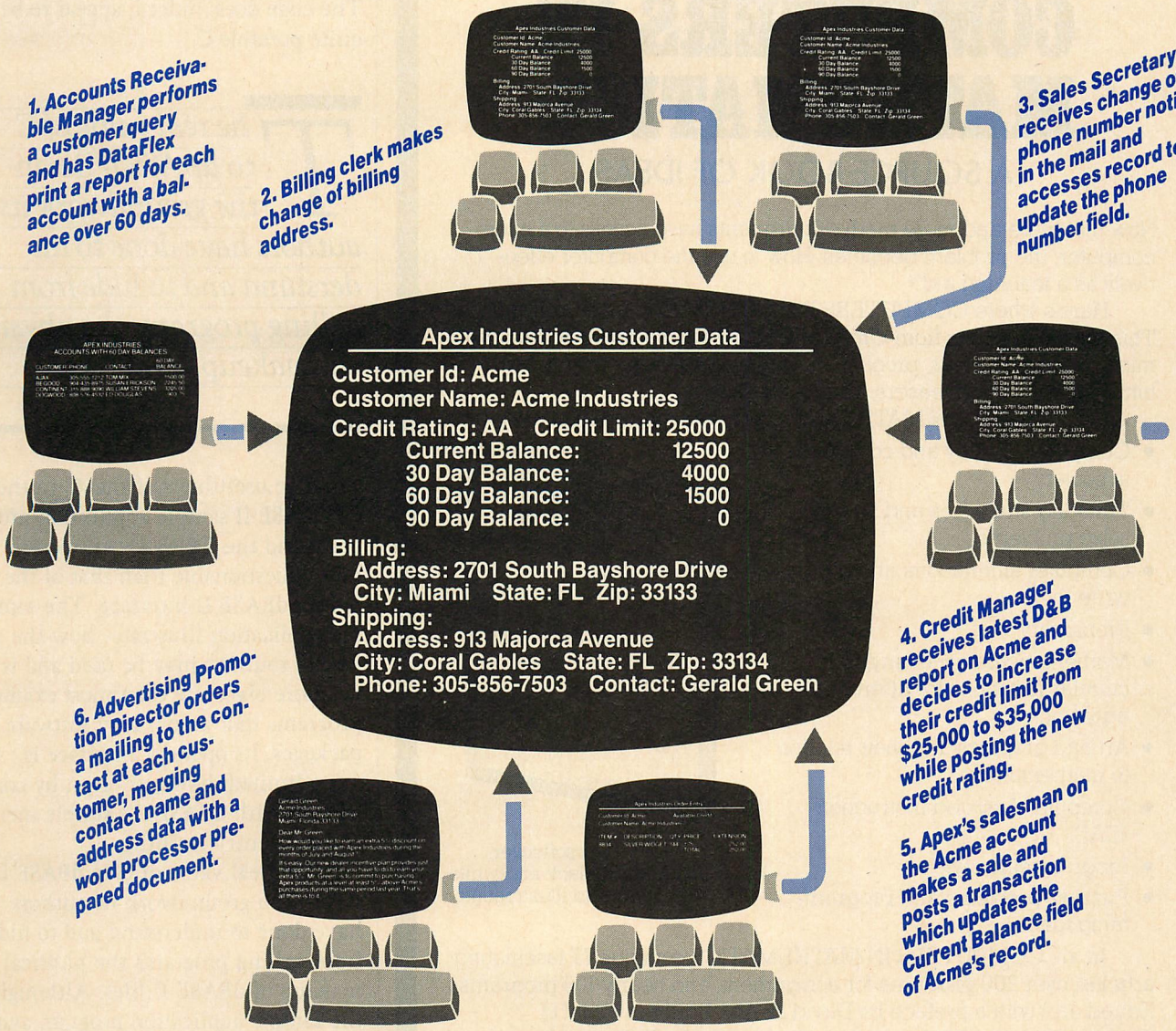
dwrite();               /* rewrite the record */
dclose();               /* close the file */
dfree();                /* release the master control structure*/
```

Figure 1: Sequence of Calls to C to dBASE II

Although the package is not a stellar example of program structure, it could provide a useful model for a software developer undertaking the transportation of a C language/dBASE II application to an environment other than PC/MS-DOS or CP/M in that it localizes both terminal and file

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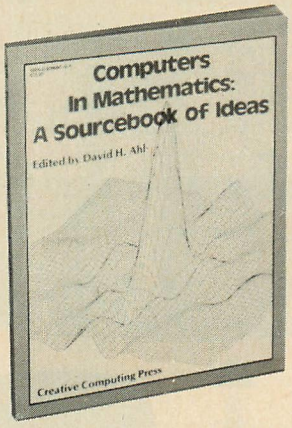
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C TO dBASE II

system interface well. Computer Innovations expresses its optimism that the package's C code could be easily transported to other environments. The code does, indeed, *appear to be* quite portable C.

The real value of C to dBASE II lies in the groundwork its authors have done to understand and to hide from calling programs the physical makeup of dBASE II files.

The usefulness of the 48 in the C2DBASE II sample application program and the TERMINAL module is more questionable than that of the kernel dBASE II interface. The sample application illustrates how the kernel routines may be used and is far more elaborate than most example programs that accompany software packages. Its operator interface is quite limited, however, even by comparison with dBASE II's simple menu and data entry facilities.

The real value of C to dBASE II lies in the groundwork its authors have done to understand and to hide from calling programs the physical makeup of dBASE II files. Although the sample application program and terminal interface routines that make up the bulk of the package are weak except as a sort of documentation, the package's basic file manipulation capabilities are useful and worthwhile.

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ROLAND M. BROWN III

SMOOTH SAILING

Chart an easy course through dBASE II with this program generator

Using dBASE II to code those sharp data entry screens that clients love is akin to sliding slivers of bamboo beneath the nails of each finger. As a result, our industry has seen a proliferation of screen generators, command file generators, and numerous other dBASE II enhancements. One of the more recent entries into this field of dBASE enhancements is fastBASE by Fourcolor Data Systems Inc., in Dayton, Ohio. This product is one of the best of the generator packages.

The fastBASE system includes a utility program, a merge generator, a form letter utility, a file management generator, a report generator, and a screen generator. The report generator alone would be worth the price.

The whole fastBASE package is well designed and integrated. Screens and menus in each program are consistent and uncluttered, reflecting the obvious care and thought that went into the design of the package. The system is not without problems, but none is serious enough to impede its usefulness to the dBASE II programmer. Indeed, Fourcolor, the manufacturer, was aware of all but one of the problems mentioned in this report and provided quick solutions. Fourcolor also states that the problems are resolved in the new version V2.0, which should be available by the time this article is published.

The testing for this review was done on an IBM PC with 128k memory, two DSDD drives, monochrome display and adapter, and an Epson FX-80 printer, using fastBASE V1.7 and dBASE II V2.3B. Every attempt was made to confuse the programs by entering erron-

Roland M. Brown III was for 10 years a senior programmer/analyst involved in on-line communication systems and data base systems. Currently he is a pastor in the United Methodist Church.

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eous data, overlapping fields in the report generator screen, and supplying non-existent field names in other sections of the program. fastBASE would not be fooled.

The people at Fourcolor state that if dBASE II version 2.3B or later runs on a system configuration, fastBASE will also. The fastBASE programs were tested using DOS 1.1 and 2.0 and no problems were encountered with either operating system.

The fastBASE programs are menu-driven routines that generate command files for dBASE II. With fastBASE the user can generate command files that will add, delete, or modify records and search for and print individual records or lists of records from one data base or several linked data bases. The file management/search and the merge generators will also create a data base file.

The only functions that fastBASE does not include are the ability to generate a command file that will handle updating one data base file with the data from another data base and the ability to update by adding or subtracting transaction amounts. These functions are available, however, in V2.0.

All of the command files except those created by the screen generator are stand-alone command files. All of the functions needed for a particular process (file maintenance, merging, etc.) are contained within fastBASE's generated command files.

The screen generator creates a command file that is designed to be called by a user command file when the user wants either to display data on the screen or to allow data entry. This allows the user to generate a screen format for data display or entry just once. When data entry or display functions are desired, the command file need only access the record to be displayed or modified and call the fastBASE screen command file with the dBASE II DO command.

The system's attribute file makes it easy to use. Each program (except the utility) generates an attribute file that saves all of the user's entries the first time a system is developed. fastBASE also offers suggested prompts to the user whenever the program has enough information to provide an appropriate response.

The one serious drawback to fastBASE's usefulness is its manual. Like those for so many other microcomputer software products, fastBASE's manual is abysmal. Anyone experienced in dBASE II will have no problem getting the system to perform to its full potential, but until Fourcolor provides the new manual, the novice had better steer clear.

UTILITY PROGRAM

The fastBASE programs range from simple to complex. The utility pro-

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gram is simple, providing three functions that modify dBASE II command files: Squish, Structure, and Combine. Squish does just what its name implies; it condenses the command file by removing leading blanks and comment lines. Theoretically, it should take less time to execute a command file if there are fewer characters.

The Structure program reverses the Squish operation, providing a more readable file (for example, by indenting commands within a DO WHILE loop). Combine is another function designed to speed run-time execution. It does that by replacing the DO commands within a command file with the contents of the command file being called. The Combine option will combine only on the first level. If a called command file calls still another command file, the user must run the Combine function repeatedly until all called command files are merged.

Although Squish and Combine are designed to speed run-time execution, tests of these functions show no measurable increase in speed. Theoretically, removing the extra spaces and merging called command files should speed the run-time by reducing file size and lessening disk access. Because dBASE II cannot keep large command files totally memory resident, however, dBASE II must still access the disks to process the command files, which negates the advantage of Squish and Combine.

These programs all look for the CP/M file extension (.CMD) instead of the PC-DOS default of .PRG. This is not a problem for the user, since dBASE II will accept almost any file extension for a command file as long as it is specified and not used by dBASE II for other functions. The fastBASE programs also allow the user to specify the extension when using Combine.

File Management Generator

The heart of the fastBASE system, the file management generator, is

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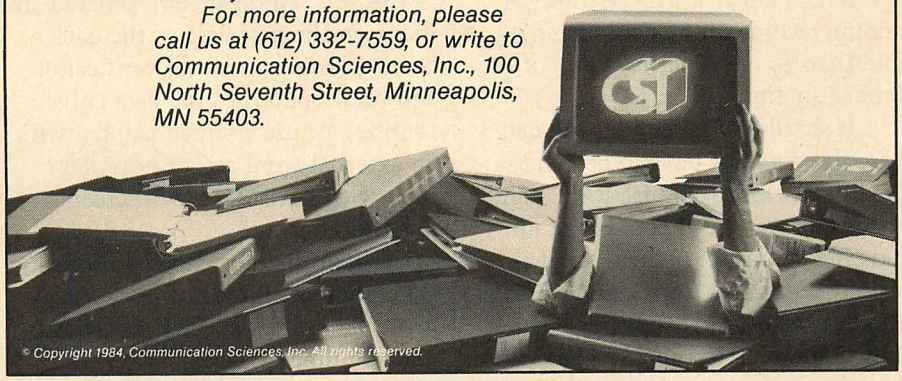
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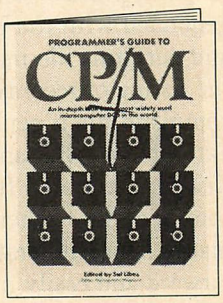


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more complex in its design and use. It builds two command files that allow the user under dBASE II to add, delete, modify, list (on the printer or screen), and search for records in a data base file. In addition, the program will allow the user to define up to seven index files—the maximum allowed by dBASE II—and will generate the code within the command file to create the index files. After the command files are generated and the data base created, the user need only load dBASE II and call the command file generated by fastBASE to begin adding records to the data base file and then go on to perform any of the other functions.

It should be noted that the data base file does not have to be generated by fastBASE; the fastBASE command files can be generated for an existing data base. If they are, it would be helpful for the user to copy the data base (using the copy structure command) to the disk that will be used to generate command files, so fastBASE can prompt the user with the field names.

The primary command file is generated with the extension .CMD and performs file maintenance and the listing of records. The second command file is generated with the extension of .SER and is called by the first for the search functions. The command files generated by the file maintenance generator are straightforward and easily modified for any special functions desired.

When the user invokes the file maintenance program, he is asked for the master name for the data files. The master name then becomes the root name for all the files used within the generated dBASE II system (for example, if the user enters "MUSIC" as the master name, the main command file will be MUSIC.CMD, the search command file will be MUSIC.SER, and the data base file will be MUSIC.DBF).

The user is then given the opportunity to set some system parameter values. He may change the file

```
A. PAINT SCREEN AND DEFINE STOPS
B. SEQUENCE STOPS
C. CREATE DATABASE FILE
D. DEFINE INDEX FILES
E. DEFINE REORGANIZATION AND
   ACTIVE RECORD LOGIC
F. DEFINE SEARCH AND LIST REPORT
G. GENERATE COMMAND FILE
S. SAVE fastBASE DATA INPUT TO
   ATTRIBUTE FILE
Z. EXIT PROGRAM
     CHOICE? (A-Z):
```

Figure 1: fastBASE File Maintenance Generator

names used within the system, allow fastBASE to automatically generate an index on the first field of the data base, include or exclude verification and print options in the data entry routines, or use a screen painted with an external word processor rather than with fastBASE's own screen-painting routines.

When the user chooses automatic generation of an index file on the first field of the data base, if the first field is numeric, fastBASE generates the code in the command file to automatically increment the field by one each time a record is added.

The advantage of the option that allows the user to paint the screen with an external word processor is that the screen layout can be created with a word processor and accessed by both the file management generator and the screen generator. However, fastBASE's own screen-painting routine is so simple and easy to use that I did not find this option a compelling necessity. Even if this option is chosen, the user must still use the fastBASE screen-painting routine to set the data entry positions, or "stops," as described later.

The main menu screen (see figure 1) is logical and well ordered. If the user proceeds from A to Z, an entire file maintenance system can be generated in as few as 20 minutes (less if it is an extremely simple system). fastBASE requires the user to perform the functions in a logical order. For example, the file maintenance generator does not allow the user to generate the data base before he has defined the fields by painting the data entry screens.

When option A, "Paint Screen and Define Stops," is chosen, the user is given a blank screen on which he places the text to be used for data entry prompts. He then locates the data entry positions on the screen. When a tab is set, the user is prompted to enter a field name, data type, field length, number of decimal positions, and PICTURE. The user is also allowed to enter range values for data validation in valid dBASE II format, for example,

cusno > 100 .AND. cusno < 300

fastBASE uses all of this information when generating the command file structure (option C on the main menu).

Option B, "Sequence Stops," allows the user to specify the sequence of data entry in the add/modify option of the file maintenance command file. Choosing automatic sequence, or not performing this option, generates a data entry sequence of left to right and top to bottom.

Options C and D, "Create Data Base File" and "Define Index File," generate the data base and allow the user to specify index files using the information from the paint screen and sequencing functions. A maximum of seven index files may be used, with the indexes based upon single fields or combinations of fields. Field name prompts appear at the bottom of the screen.

Option E, "Define Reorganization and Active Record Logic," allows the user to define a field whose value will indicate whether the record is active or inactive. When the data base is reorganized, all inactive records are removed from the file.

Option F, "Define Search and List Report," is a way of producing a report similar to a .FRM file. The user enters column headings on the first line and sets the data locations on the second line. If this function is not chosen, fastBASE generates a report format with as much information

from the data base file as can be placed on one line. The format file is used by the list and search functions in the generated command file.

Options G and S, "Generate Command File" and "Save fastBASE Data Input to Attribute File," perform their functions based upon the information given in the other functions. The exit option, Z, asks the user if it should save the attribute file before exiting, after which it exits.

As mentioned before, attribute files contain the entries made by the user during the fastBASE programs. Everything is saved, from the names of the data base file and fields to the actual layout of the screen. The advantage of this file becomes apparent when the user decides to modify the system. With the attribute file the user does not need to reenter all of the information for the particular generator to change one element. For example, to change the sequence of the data entry or the position of a data prompt, or even to add another index file, the user need only enter the new data. After the new information has been added, a new command file can immediately be generated.

There were some minor bugs in the generated search command file (.SER). The program was not able to find records by the first automatically generated index field, and the fast search routine (which lists ten records at a time on the screen) went into a loop that displayed the last screen a number of times when it hit end of file. Both bugs were easily fixed within the command file. The people at Fourcolor not only knew of the bugs, they also forewarned me of their existence. They also state that the bugs have been corrected in the new version of the program.

To obtain an idea of the functions generated by the file maintenance generator, see figure 2, which shows a screen displayed by the generated command file while running under dBASE II. The screens generated by the search function can be seen by looking at figures 3 and 4. In the search command file, provision is made for searching for records using every field in the file in addition to the indexed fields. Searching on the nonindexed fields is more time consuming than searching on an indexed field, since the search must be done sequentially using LOCATE rather than the faster FIND command.

Report Generator

The report generator is a tremendous timesaver for the dBASE II programmer. It can generate reports using a single data base or a linked primary and secondary data base. Reports are formatted in two ways: the first uses a free-form report format that is 132 characters wide and 60 lines long; the

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second uses a screen that is 132 characters wide and 17 lines long to prepare columnar reports.

The free-form report format would be used to generate report formats for insurance forms, tax forms, and other forms used in printing. The columnar report form would be used for reports that involve lists of items and that require totals and subtotals. The columnar report can subtotal on three levels for primary records and on one level for secondary records. It can grand-total on either primary or secondary records.

Owners of dot-matrix printers that require control character sequences to enable 132 column print mode must either change the generated code or write a short command file to send the control codes and call the report generator command file. The report command file cannot conditionally total fields (that is, a column total cannot be added to by data from one type of record and subtracted from by another record).

The report command file also cannot present totals in relationship to one another (i.e., the user cannot have a total of debits and a total of credits and subtract one from the other to give a balance). However, the command file could be modified to handle either of these conditions.

Fourcolor was unaware of one bug. The report generator generated a command file that would do nothing more than open and close the data base files. Fourcolor discovered within 12 hours that the report generator always expected something to be entered on one of the primary subtotal lines. Since the particular report I was trying to generate did not have any primary subtotals, it would not generate the complete command file. After I entered something on the primary subtotal lines, the program generated the command file correctly.

MERGE PROGRAM GENERATOR

The merge program generator is the most sophisticated of the generators.

```
GENERAL MUSIC FILE FILE MAINTENANCE
OPTIONS:
    A. ADD/MODIFY RECORD
    B. SEARCH FOR RECORD
    C. FILE REORGANIZATION
    D. LIST RECORDS
    R. RETURN
        CHOICE? (A-R)
NOTE: FILE REORGANIZATION WILL
      CREATE AND REBUILD INDEX
      FILES.
      THEREFORE, FOR NEW DATA
      BASE FILES DO THIS FIRST
      BEFORE SELECTING OPTIONS A,
      B OR D.
```

Figure 2: Initial Menu in Generated File Maintenance Command File

```
SEARCH METHOD:
1. SEARCH BY INDEX
2. SEARCH PART OF FIELD
METHOD? (1,2)1
SEARCH INDEX OPTIONS:
1. SEARCH BY RECORD NUMBER
2. SEARCH BY TITLE
3. SEARCH BY COMPOSER
4. SEARCH BY SEASON OR
OCCASION
5. SEARCH BY USE OF PIECE.
6. SEARCH BY TRANSLATION OF
TITLE
7. SEARCH BY HYMN TUNE
CHOICE? (1-7):
```

Figure 3: Search by Index
SEARCH FOR GENERAL MUSIC FILE

The user specifies the primary input data base and up to two secondary input data bases as well as a target data base. The target data base can either be defined field by field or specified by the user, taking the structure of one of the other input data base files as a starting point. The user then specifies the source data base and field for each of the target fields, using one of the best prompting schemes I have seen. The merge program generator worked flawlessly and the generated code contained no bugs.

SCREEN GENERATOR AND FORM LETTER GENERATOR

The screen generator is a straightforward program that generates a command file that builds a screen for data entry or display. The user can call this command file from his program. The form letter generator generates a command file that will create a form letter by merging fields from the data base with text.

The advantages of the form letter generator are that the user can use dBASE II statements (such as TRIM) to strip extra spaces from a field and that he is relieved of the tedium of coding all those "@ x,y SAY" commands. This is indeed an advantage over sending records to a word processor in SDF (system data format) if the word processor cannot strip the extra spaces from the fields.

For the experienced dBASE II programmer, fastBASE is easy to use. I got the programs to work just by reading the prompts, which are so consistently designed that it is easy to use any of the functions.

INSTALLATION

The system comes with an install program used to define the terminal on which fastBASE will run. More than 30 different terminals are supported. Although the IBM PC is listed and installs properly, the cursor control keys cannot be used. Instead, the user must use the standard dBASE II (à la WordStar) control sequences to move the cursor.

The programs come on two DSDD disks with installation instructions in a print-out attached to the licensing agreement. The documentation clearly states that the terminal file created by the install program must be on every disk that contains an .EXE file. There is only a glancing reference to small-capacity disk systems (Apple is specifically mentioned) with the suggestion that programs be split up over several disks.

Knowing that standard Apple disks have 140K capacity, I assumed that the document was not referring to my drives (320K or 360K). I was wrong. The programs do need to be divided over several disks since the program disks need a large amount of

```
SEARCH METHOD:

  1. SEARCH BY INDEX
  2. SEARCH PART OF FIELD

  METHOD? (1,2) 2

SELECT FIELD NUMBER

ENTER SEARCH DATA

 1. COMPOSER  2. TITLE     3. TUNE
 4. USE       5. SEASON    6. BOOK
 7. VOLUME    8. PAGESEC   9. TRANS
10. KEY      11. DATE     12. VERSE
```

Figure 4: Search by Field

space for work files used during command file generation. The easiest solution was to put the file maintenance and utility programs on one disk, the report and merge programs on another, and the screen generator and form letter program on another. The programs then always generated their data files on the same disk.

When Fourcolor updates the documentation, it should also provide a more detailed set of installation instructions. One of the reservations I have about the novice using fastBASE is that the manual never mentions simple procedures the novice will need to know (for example, the generated command file needs to be copied to the disk the user will use when running dBASE II).

CONCLUSION

There are a few bells and whistles that I would like to see added to the system, but only one seems really important: the report generators should provide the user with the field names when screens are being painted.

fastBASE is a useful series of programs that can generate command files used by dBASE II. It took five minutes to generate the command files created by the file maintenance generator and well under a minute for the other command file generators. With the addition of an update command file of the user's design, the user can generate an entire command file system for almost any application. fastBASE will not do everything, but it will make report and file maintenance in dBASE II easier.

The fastBASE system does not provide a facility for querying and displaying data from more than one data base, but the report generator does. The report command file could easily be modified to place the display on the screen by deleting the SET FORMAT TO PRINT command in the command file. The user would also need to modify the file-handling routines to allow the program to pause after the screen is filled and to limit the number of lines per display, etc. (this is not as simple a process, but it is possible).

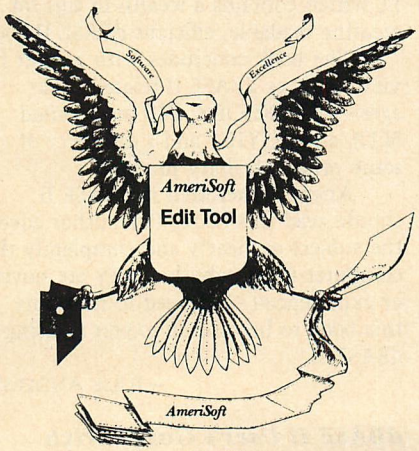
What about the people at Fourcolor? They seem to be genuinely interested in serving their users. When I discovered the bug in the report generator, they seemed almost pleased to have someone uncover a potential problem for their users.

In short, fastBASE is an excellent tool for the dBASE II developer. It can help relieve the tedium involved in basic dBASE II system development. When an improved manual is added to the package, fastBASE will be a difficult system to beat.

fastBASE
Fourcolor Data Systems Inc.
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Dayton, Ohio 45459
513-433-3780
$195

Written in CB80 (CB86)
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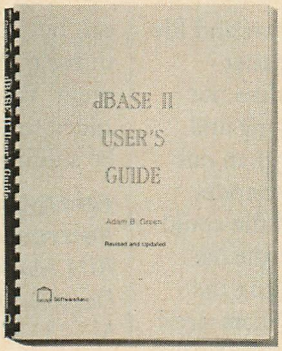
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as long as 60,000 bytes

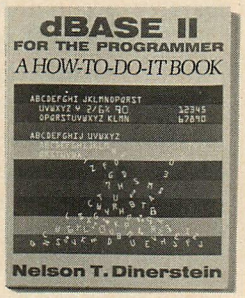
Hex/EBCDIC Editing

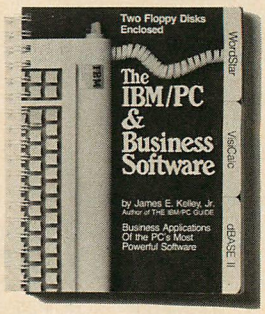
CIRCLE NO. 166 ON READER SERVICE CARD

AmeriSoft ™
(707) 778-8594 • (707) 762-0640
345 S. McDowell Blvd., Ste. 410
Petaluma, CA 94952









Using dBASE II
Carl Townsend
(Osborne/McGraw-Hill, Berkeley, 1984)
223 pages, paper, $18.95

Novices as well as experienced programmers will find this excellent tutorial a valuable addition to their libraries. Clearly written, with all technical terms explained, the book can be read quickly and is so well organized that capsules can be read or skipped according to the experience level of the reader. Business and professional people will find this book especially useful, because many of the topics discussed and examples given are aimed at the problems often encountered in production work.

The book begins with definitions of records and files and progresses through advanced dBASE II programming, guiding the reader through all stages of development, from the design of the data base to the completion of the system. Throughout the book, dBASE II commands are presented as tools that can be used to solve various problems.

Of course, the more mundane chores of data base creation and maintenance, menu design, and screen generation are addressed, but the real value of the book lies in its creative solutions to the more advanced problems a system implementer is likely to face. Methods are given for constructing a quasi-data dictionary, implementing an audit trail, maintaining a system parameter file, and using arrays in screens, files, and memory variables.

Other vital topics covered include transaction processing, report generation, back-up and recovery, and procedures for debugging dBASE II code. A chapter is devoted to integrating dBASE II files with other programs, such as WordStar, SuperCalc, and BASIC. CP/M programmers will find examples that apply specifically to their environment.

The author even explains how to use dBASE II in a network-type data base organization, although he concedes that because dBASE II was designed specifically for relational data base organization, and the procedures required to perform a query on a network-type data base will result in such poor performance that the user will be discouraged from attempting to implement this structure.

Each topic is illustrated with sample programs that are paradigms of good structured programming techniques and are easy to read and understand. The reader has only to transfer the principles to his own applications to create a customized system. If he needs help with the details of customizing his system, he can probably get answers from appendix D, which contains a wealth of tips for creating readable, efficient dBASE II code.

The book concludes with a short review of three dBASE II-related packages—QUICKCODE, ZIP (now called SED), and dUTIL—and a directory of some other ancillary products.

Anyone interested in dBASE II should read this book. The author covers the subject so clearly and completely that computer users, whether they are novice or experienced, will need to read only this book to become an expert at using dBASE II.

—JULIE ANDERSON

dBASE II User's Guide with Applications
Adam B. Green
Prentice-Hall
151 pages, paper, $29

Written as a supplement to the dBASE II manual, this book is aimed at the newcomer to dBASE II. Unfortunately, a newcomer will probably be confused by the first chapter, which is intended to get the user running the program as soon as possible. A tutorial on dBASE II, particularly one intended for beginners, should give a clear explanation of files, records, fields, and data bases. Green starts off with an opaque description of these terms that is guaranteed to leave the beginner bewildered. There aren't even any examples given.

The rest of the chapter is even more confusing. In just 22 pages. Green covers almost all of the dBASE II commands, using about half a page for an example of each. The examples lack coherence and seem to have been randomly chosen; it would have been more useful to create a data base and then do some real-life manipulations on the data.

Chapter 3 plunges right into programming in dBASE II. Again, the author states that the material assumes no programming background, but the chapter is too advanced for a beginner and too elementary for a programmer. Although Green specifically states that this book is meant to supplement, not replace, the dBASE II manual, most people would find it hard to keep switching back and forth between his book and the documentation to find out everything necessary about a particular command.

The book does present some valuable examples of creating menus, using multiple conditionals (CASE), but nested IF . . THEN . . ELSE statements are not mentioned. Although I don't have much experience in writing dBASE II programs, there wasn't anything in this chapter that I couldn't have gotten from the documentation, particularly since Ashton-Tate has started shipping an on-screen tutorial with dBASE II.

The remainder of the book talks about designing a complete dBASE II system. The example used is a mailing list of college alumni, and a complete explanation is given as to what types of information should be entered into the data base, what the program should be able to do with the records, and how information can be easily retrieved. These chapters are clearer than the previous ones, but understanding them would be hard based on the first two chapters.

Green is certainly enthusiastic about his subject. When he explains the USE command, he says that BASIC programmers will be thrilled to know that USE replaces the OPEN and FIELD statements and, further, that this alone should justify a switch to dBASE II. Although dBASE II may be useful for setting up a data base, I think a programmer interested in graphics, number crunching, or word processing might object to writing such applications in dBASE II.

Although this book does contain some useful information about dBASE II, that information is probably more readily available elsewhere.

—SUSAN GLINERT-COLE

dBASE II for the Programmer
Nelson T. Dinerstein
Scott, Foresman, and Company
166 pages, paper, $17.95

Although many books are appearing on the market to help the novice dBASE II programmer, few address complex programming problems. Beginners' texts often end after discussing the features of dBASE II and giving a few simple examples, leaving a programmer wondering what to do next. This gap has been filled by Nelson Dinerstein's *dBASE II for the Programmer.*

The book addresses good programming practice in general, with specific emphasis on writing dBASE II application programs. The first few chapters discuss the elements of dBASE II, working with files, and technical hints. The second half develops an example data base.

The introduction is an overview of problem solving with dBASE II. Some suggested programming goals, such as flexibility and attention to the human interface, are presented. The points are well taken, and the author illustrates each one by presenting the reader with typical problems encountered in designing application programs, followed by general advice, cautions, and suggested solutions. I appreciated the author's warning that dBASE II functions do not always work as advertised.

The book assumes some knowledge of dBASE II, but chapter 2 gives an overview of the language elements. Functions, reserved words, and concepts are presented, with excellent explanations and examples. The examples are so good, in fact, that a programmer with some experience in other areas could probably learn dBASE II with this book and the dBASE II manual.

Fundamental programming concepts, such as obtaining user input, producing output, and looping, are briefly presented in chapter 3. This chapter is an anomaly; it is only two pages long, and its concepts are better presented elsewhere.

Chapter 4 covers data base files: how to specify, create, manipulate, and access them. All the concepts are illustrated with examples and with discussions of the underlying programming strategy.

Chapter 5 is the most useful chapter in the book. It is devoted to programming hints and useful suggestions about constructing menus, controlling overlays, maintaining modularity, and increasing the application's efficiency. There is a wealth of information here that is not documented in the dBASE II manual, including discussions of problems inherent in certain functions and how to interface dBASE II programs to the outside world. A section of the chapter is devoted to "System Limitations" (subtitled "Disasters and Hints"). Crash-provoking actions are listed here; this section is guaranteed to save a programmer from some unexpected (and undesirable) surprises.

The second half of the book is devoted to an illustrative example of the principles described in the earlier chapters. A complex problem is presented, analyzed, and developed into a large (about 55 pages) program. The final chapter discusses the cryptic dBASE II error messages—what they really mean, what might be causing the problem, and what corrective actions could be taken.

There is little to criticize here: the book is well laid out, and the graphic design is excellent. Unfortunately, it doesn't lie flat on the desk, which, although a minor point, is sufficiently aggravating to be mentioned. A reader should not have to pound a book binding or hunt around for a heavy rock to keep the book at the desired page.

dBASE II for the Programmer is packed full of extremely useful, well-presented information and should find a place on every dBASE II programmer's bookshelf.

—S.G-C.

The IBM/PC & Business Software
James E. Kelley, Jr.
Banbury Books, 1983
341 pages, paper, $39.95

The IBM/PC & Business Software is a valuable aid for quickly absorbing the basic concepts of dBASE II, WordStar, and VisiCalc. The book devotes one section to each of these three popular software packages, and three appendices explain how to turn on the PC, format disks, make back-ups, and prepare working diskettes for each of the three programs. It is difficult to write a tutorial that neither bores nor patronizes, but Kelley has done an excellent job of presenting the material for each section in a friendly, clear, and organized manner.

Two diskettes, included with the manual, supply many example programs for each of the software packages. Having these examples on diskette saves the reader a lot of typing time. The program listings can be studied as examples to help in setting up VisiCalc worksheets and programming in dBASE II.

The initial section on dBASE II explains the concept of a data base and what to do if the program crashes. The user is then led through the dBASE II commands using the author's genealogy chart as a data base. Although the subject matter may be of interest only to Kelleys of a certain blood line, the example is well chosen; the genealogy chart is fairly extensive, lends itself to many different manipulations, and is not overly complicated. The manual offers a series of exercises in getting information out of data bases, doing file manipulation, indexing, sorting, setting up command files, using macros and memory variables, and personalizing the genealogy chart.

The next section of the dBASE II chapter begins with an explanation of the steps required to create and modify data base structures. This is followed by exercises with the dBASE II APPEND command and with more advanced searching and sorting facilities that can be constructed with command files. Throughout this section the author digresses into discussions of file organization, what to look for in a data base, and how data bases can be used.

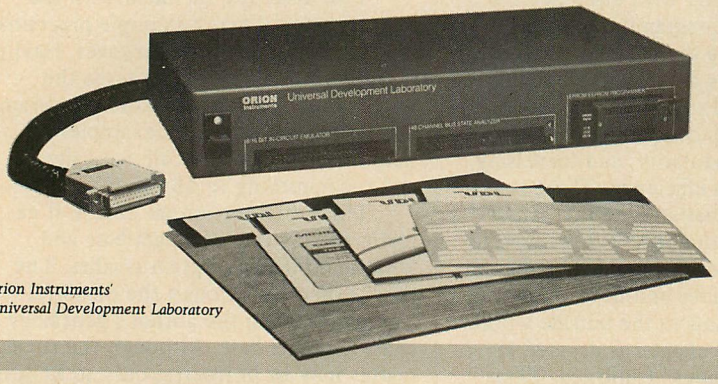
The final section of this chapter covers report generation, but there is no information about the FORMAT command or about designing a report form with the SET FORMAT TO PRINT statement. Although FORMAT commands are used in advanced applications, they are not well explained in the dBASE II manual; coverage here would have been valuable.

Although the author emphasizes reading the dBASE II manual for detailed information, the explanations that he provides are so clear that there is little more that the manual could add. In fact, this book includes quite a few little-known but valuable tricks using the dBASE II commands that certainly are nowhere to be found in the dBASE II documentation. Overall, this is one of the best off-screen tutorials on the market.

—S.G-C.

TECH RELEASES

Hardware, software, and other developments for the PC



Orion Instruments' Universal Development Laboratory



Sears Monitor/Television

HARDWARE

A system that links the enhanced IBM PC/XT to the IBM VM/CMS or TSO mainframes has been developed by **CAP Gemini Software Products, Inc.** The **Multipro Application Development Workstation,** which replaces the traditional 3270-type terminal, allows programmers to download systems design and programming tasks from the mainframe to the PC/XT workstations, saving mainframe resources and improving response time. Necessary enhancements to the existing PC/XT include the addition of a standard communications interface to provide compatibility with the IBM mainframe. The Multipro system's features include a window management function, with transfer of data between windows made possible with a cut-and-past facility; a project library containing interfaces to popular library systems such as ADR's Librarian; a flexible document generating facility; complete calculator functions; a project management facility; an editing facility similar to, but more powerful than SPF or XEDIT. Price of the mainframe package is $24,000; software for each workstation is $1,900.

CAP GEMINI SOFTWARE PRODUCTS, INC.
2350 Valley View Lane
Dallas, TX 75234
214-247-5454

CIRCLE 460 ON READER SERVICE CARD



Orion Instruments' new **Universal Development Laboratory** is an analyzer/emulator programmer pod that can turn a personal computer into a development system. Into a single pod-size box it integrates a 48-channel bus state analyzer, an 8/16-bit emulator, an EPROM programmer, and an input stimulus generator. Virtually any personal computer can act as an integrated control console for the instruments via a single RS-232 cable. A high-level control program runs on the host computer and coordinates disk, printer, and instrument resources into an efficient integrated environment. Up to 128K bytes of 195ns ROM can be emulated in either an 8- or 16-bit mode. $2,395.

ORION INSTRUMENTS
172 Otis Avenue
Woodside, CA 94062
415-851-1172

CIRCLE 461 ON READER SERVICE CARD

From **Sears** comes a 13-inch **television that doubles as a video monitor.** It features a higher resolution, monitor-grade picture tube, RGB/video/TV modes, a green display switch, screen compression, and horizontal centering. The RGB mode accommodates the IBM PC and PC*jr*. In RGB mode, the monitor's screen compression control may be used to compress displayed material to about 70 percent of original height for improved clarity. Also in RGB, the monitor displays up to 2,000 characters at a time, with 80 characters possible per line. Model 4084, $350. Available in 1984 Spring/Summer general catalog, selected larger Sears stores, and Sears Business Systems Centers.

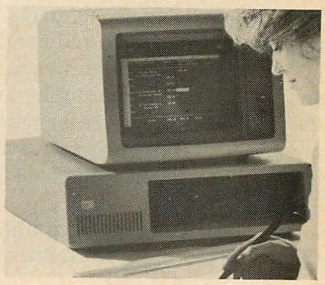
SEARS, ROEBUCK AND COMPANY
Department 703-BSC 40-15
Sears Tower
Chicago, IL 60684
312-875-8306

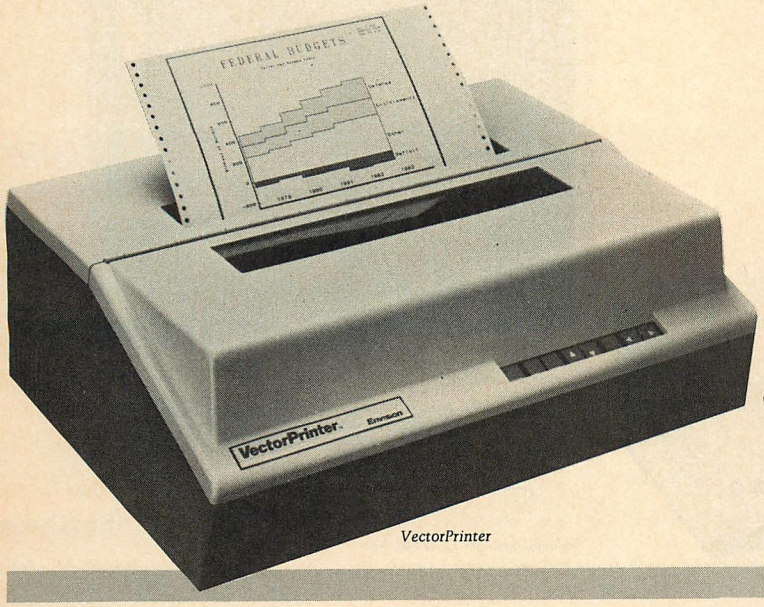
CIRCLE 462 ON READER SERVICE CARD

"The mouse that writes," a writing tablet and electronically controlled pen known as **PenPad,** has been introduced by **Pencept, Inc.** for the IBM PC. Penpad offers mouse functions as well as accepting printed data, text or graphics in real time. It recognizes capital letters A-Z, numerals 0-9, and 23 other symbols. Penpad works unmodified with Lotus 1-2-3, Visicalc, Multiplan, and WordStar and has been specially adapted to work with VersaForm. $995.

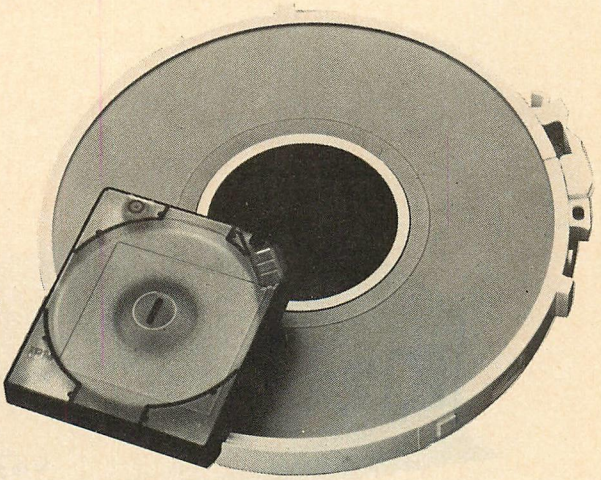
PENCEPT, INC.
39 Green Street
Waltham, MA 02154
617-893-6390

CIRCLE 463 ON READER SERVICE CARD





VectorPrinter

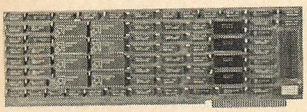


IBM's 3480 Magnetic Tape Subsystem

The **LA-200** from **Total Logic Corporation** transforms the PC or XT into a logic analyzer. The LA-200 is a hardware-software subsystem consisting of a plug-in card, test cables, color-coded probe pod, menu-driven software, and a user's manual. The data path is 32 bits wide and the memory depth is 1,024 data words. With a user-supplied clock, the analyzer operates synchronously or asynchronously up to 15 MHz. $1,950.

TOTAL LOGIC CORP.
343 W. Drake, Suite 110
Fort Collins, CO 80526
303-226-5980

CIRCLE 464 ON READER SERVICE CARD



A new generation of magnetic tape drives from **IBM** replaces the familiar reel of tape with an easy-to-handle cartridge, more than doubles the rate at which tape devices transfer information, and offers significantly greater data reliability. (Although this is not of immediate interest to PC owners and users, it may reflect future trends that could impact the desk-top computer.) The new drives, part of the **IBM 3480** magnetic tape subsystem, achieve major reductions in space, power, and maintenance requirements. The small, rectangular cartridge used in the IBM 3480 tape subsystem is about one-fourth the size of a standard 10½-inch reel of magnetic tape, yet it stores up to 20 percent more data—a total of 200 million characters. The rapid rate at which data can be stored or retrieved on the tape is the result of using 18 recording tracks and achieving a linear data recording density of about 38,000 bytes per inch—six times the density used in current IBM tape drives. $200,000-plus.

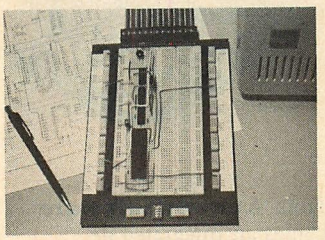
IBM
Information Systems Group
900 King Street
Rye Brook, NY 10573
914-934-4488

CIRCLE 465 ON READER SERVICE CARD

From **Sabadia Export Corporation** comes the **eZ Board,** a solderless experimenter system for building experimental add-ons to interface with personal computers. Features include a glass epoxy printed circuit board mounted with a set of solderless breadboarding units for building circuits. Four separate distribution buses with 50 tie-points each can be used for power, ground, clock lines, and reset commands. The eZ Board's breadboarding area consists of 1,460 tie-points with a capacity of sixteen 14-pin DIPs. $174.95, plus $5 shipping.

SABADIA EXPORT CORPORATION
3920 E. Coronado Street
Suite 206
Anaheim, CA 92807
714-630-9335

CIRCLE 466 ON READER SERVICE CARD



The VectorPrinter, a high resolution, color, dot matrix printer that combines text and graphics capabilities, now is available to IBM PC users. Manufactured by **Envision,** the VectorPrinter is compatible with the Diablo 630 family of printers and Hewlett-Packard's HP7470A, 7475 and 7220 pen plotters, enabling it to run a variety of word processing and graphics programs. Additional software is available by adding Envision's ColorCopy screen copy program. The VectorPrinter offers letter-quality printing at 100 characters per second and draft quality at 300 cps. Price: $3,495; volume discounts are available.

ENVISION
631 River Oaks Parkway
San Jose, CA 95134
408-946-9755

CIRCLE 467 ON READER SERVICE CARD

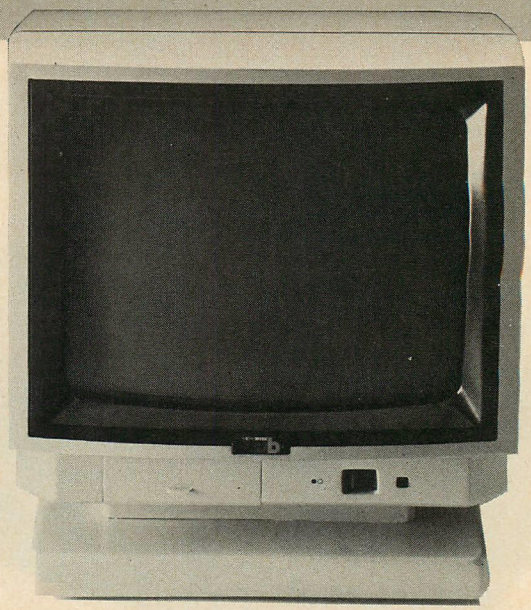
Colby Computer's new **PC-compatible single board** has been designed to be physically identical to the IBM PC board. It is an 8½- by 12-inch printed circuit board that can hold up to 256K of RAM (using 64K RAM chips) or up to 1 Mbyte of RAM (using 256K RAM chips, 8K of EPROM, an integrated floppy disk controller that can operate dual 5¼-inch floppy drives, an integrated SASI Hard Disc Interface, and an 8088 processor with an optional 8087 coprocessor. $569; OEM quantities $369.

COLBY COMPUTER
849 Independence Avenue
Mountain View, CA 94043
415-968-1410

CIRCLE 468 ON READER SERVICE CARD



DataTalker II from Winterhalter



Techland Systems' CUB Monitor

Techland Systems has introduced its **Microvitec Cub** ultra-high-resolution color monitors to the U.S. market. Capable of supporting either interlaced or non-interlaced graphics modes, Cub color monitors offer resolution quality previously available in the U.S. only at a higher price. The 14-inch Cub monitor, with displays IRGB as defined on the IBM PC, has the ability to address 895 X 585 pixels with a .31 dot pitch. Currently, conventional color monitors for personal computers provide 640 pixels across and 200 down, with a .43 dot pitch. Techland offers a variety of custom configurations. $1,290.

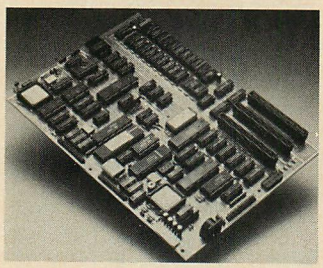
TECHLAND SYSTEMS
25 Waterside Plaza
New York, NY 10010
212-684-7788

CIRCLE 469 ON READER SERVICE CARD

Faraday Electronics has introduced the **FE Model 6410 series of micro-CPUs,** products that offer OEMs improved price and function, with the option of a floppy disk controller and/or monochrome video display controller integrated on the CPU board. The two-layer boards include 64K or 128K of parity checked RAM, 32K of EPROM space, parallel port, serial port, IBM PC-compatible keyboard port, and three IBM PC-compatible expansion slots. It sells for $275 in OEM quantities.

FARADAY
ELECTRONICS
1029 Corporation Way
Palo Alto, CA 94303
415-961-0600

CIRCLE 470 ON READER SERVICE CARD



From **Answer Software** comes an integrated debugging tool that combines real-time trace and hardware breakpoints with performance analysis. The **Program Development Tool (PDT-PC)** consists of a PC, a cable that connects to the 8088 socket, and a diskette containing the debugging software. PDT-PC supports both Intel and PC-DOS languages, allowing program debug and analysis using the local and public symbols in addition to line numbers if using a high-level language such as C or Pascal. $1,775.

ANSWER SOFTWARE
10863 Stevens Creek Blvd.
Cupertino, CA 95014
408-253-7515

CIRCLE 471 ON READER SERVICE CARD

The **DataTalker II,** a stand-alone, front-end intelligent communications processor from **Winterhalter, Inc.,** is now compatible with PC*jr*. It plugs into junior's RS-232 serial port, allowing PC*jr* to emulate the 3270 interactive terminals and the 3780/2780 remote batch terminals. $995.

WINTERHALTER, INC.
3853 Research Park Dr.
Ann Arbor MI 48104
313-662-2002

CIRCLE 472 ON READER SERVICE CARD

The latest nine-track tape drive from **Telebyte Technology, Inc.** has been introduced for the IBM PC. **TDX-1000** is a half-inch, dual density reel-to-reel drive with a tape speed of 45 inches per second. Telebyte has provided both the hardware and software interface capability to allow the PC to read and write mainframe computer tapes. The complete package, including the TDX-1000, interface board, and 10-foot cable is $6,000.

TELEBYTE TECHNOLOGY, INC.
148 York Avenue
Halesite, NY 11743
516-226-0449

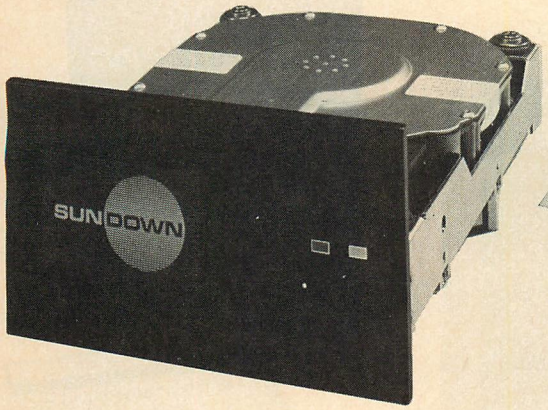
CIRCLE 473 ON READER SERVICE CARD

The new **I^2 DiskSystem** from **Interface, Inc.** provides 33.3 megabytes of formatted storage for the IBM PC under DOS 2.0. The system records at 640 tracks per inch and has an average access time of 40 milliseconds. Included are a 33-megabyte, 5¼-inch Winchester disk drive, cabinet, power supply, cable connector and I/O adapter. $2,795.

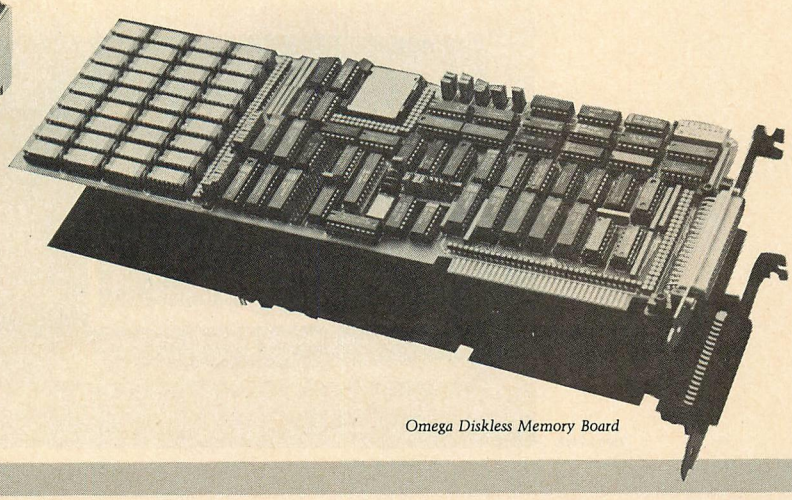
INTERFACE, INC.
7630 Alabama Avenue
Canoga Park, CA 91304
818-341-7914

CIRCLE 474 ON READER SERVICE CARD

Reactive Systems has increased the flexibility of its **Group Response System,** which links as many as 60 participants to an IBM PC, by adding a **12-button response pad** to it. System users now have 12 response options—the numbers 0 through 9 and the words "yes" and "no." Each partici-



The Sundown

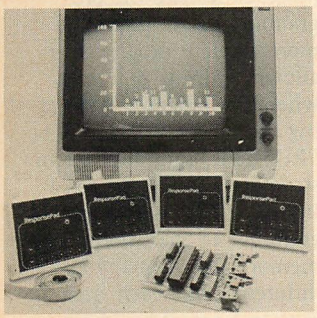


Omega Diskless Memory Board

pant uses a handheld keypad to record answers to multiple choice questions. The system then tabulates the group's responses and produces a color bar chart of the results on a video screen. The Group Response System with all programs and manual and 15 response pads sells for $1,800; Additional pads, $65 each.

REACTIVE SYSTEMS
40 N. Van Brunt Street
Englewood, NJ 07631
201-568-0481

CIRCLE 475 ON READER SERVICE CARD



A hard disk that allows IBM users to upgrade from PC to XT status and run a UNIX operating system is being offered by **Unisource Software Corporation.** Known as the **Sundown,** the 10-megabyte Winchester disk runs on the computer's existing power supply and comes fully loaded with VENIX/86, VenturCom, Inc.'s licensed version of AT&T's UNIX. VENIX/86 features a hard disk partition to permit PC-DOS/MS-DOS files and programs as well as VENIX/86; four editors; a C compiler and BASIC; document preparation post-formatting; electronic mail; debugging capability; and a variety of file management uses. Single-user VENIX/86 is $2,095; multi-user versions available.

UNISOURCE SOFTWARE CORPORATION
71 Bent Street
Cambridge, MA 02141
617-491-1264

CIRCLE 476 ON READER SERVICE CARD

Mega-Omega Systems, Inc. is marketing its **Omega Diskless Memory Board** for IBM PCs. The product consists of a main RAM board that attaches to one expansion slot in the computer and optional plug-on boards that hook up to the main board rather than using additonal slots in the computer. Among the features on the optional plug-on boards are a clock calendar; error checking and correction; a serial port to which a modem, printer, plotter or mouse can be attached; a parallel port that can be used to drive parallel printers; and an 80186 coprocessor board to increase throughput by any factor up to four. The Omega board can be configured with either 64K or 256K RAM chips. $995 with 256K of RAM.

MEGA-OMEGA SYSTEMS, INC.
5477 Glen Lakes Drive
Suite 108
Dallas, TX 75231
214-987-1340

CIRCLE 477 ON READER SERVICE CARD

SOFTWARE

VM Personal Computing, Inc. has extended the capabilities of **Relay Version 2.2,** its asynchronous communications software for the IBM PC. Enhancements include a more powerful editor, full support of additional intelligent modems, and XMODEM protocol support. A number of these improvements and a new DOS-level command—WAIT.COM—work together to give Relay Version 2.2 the capability of conducting complex file transfers even while unattended. $149.

VM PERSONAL COMPUTING, INC.
60 E. 42nd Street
New York, NY 10165
212-697-4747

CIRCLE 478 ON READER SERVICE CARD

International Data Services, Inc. has announced a UNIX port to the IBM PC/XT. **UnX-II** is an implementation of AT&T's UNIX System III with Berkeley 4.1 enhancements. It makes available to IBM PC users the powerful UNIX functions found on minicomputers, including multi-tasking and dual-user capabilities. $595.

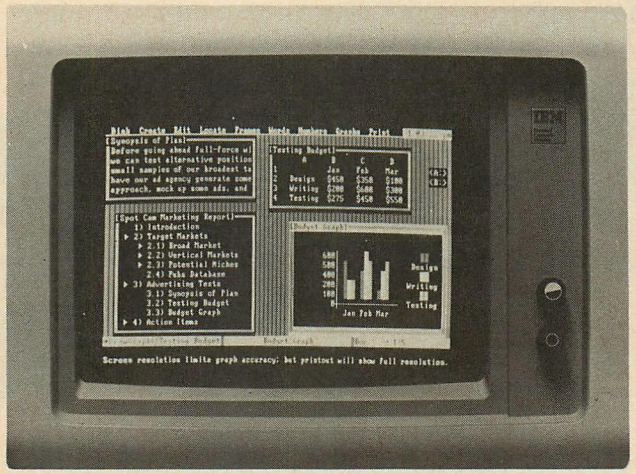
INTERNATIONAL DATA SERVICES, INC.
2231 Calle de Luna
Santa Clara, CA 95050
408-986-1972

CIRCLE 479 ON READER SERVICE CARD

From **CompuView Products** come a new utility that moves data between MS-DOS and CP/M operating systems. **SYSTRAN** runs under CP/M-86 on the IBM PC and requires two floppy disk drives (5¼ inch or 8 inch) and 64K of memory. MS-DOS is not needed on the system. SYSTRAN produces readable MS-DOS disks from CP/M disks. $120.

COMPUVIEW PRODUCTS, INC.
Suite 200
Ann Arbor, MI 48103
313-996-1299

CIRCLE 480 ON READER SERVICE CARD



Framework



Opt-Tech Sort

Opt-Tech Sort 2.0, from **Opt-Tech Data Processing,** is an assembly language sort/merge program for the IBM PC. Features of the version 2.0 include the ability to sort dBASE II files and be linked as a subroutine. The program can simultaneously sort up to 10 input files of any length or size. Variable and fixed-length data can be sorted using up to nine key fields; 1,000 records can be sorted in 10 seconds. $99.

OPT-TECH DATA PROCESSING
P.O. Box 2167
Humble, TX 77347
713-454-7428

CIRCLE 482 ON READER SERVICE CARD

Framework, a new software program from **Ashton-Tate,** will be available in early July. Touted by its manufacturers as "an entirely new software technology," Framework organizes information in an unlimited number of frames, similar to the windows used in current software. Within the frames, the user may perform the functions of word processing, spreadsheet, business graphics, data management, forms processing, and outlining. The outlining mode may be used to list other frames that then can be expanded to include text, graphics, spreadsheet, or any combination. Framework offers a tight coupling with dBASE II as well as the capability to use Lotus 1-2-3 and other ASCII files. Through its DOS access facility, PC DOS software can run in Framework. $695.

ASHTON-TATE
10150 W. Jefferson Blvd.
Culver City, CA 90230
213-204-5570

CIRCLE 481 ON READER SERVICE CARD

Purchasers of the IBM PC*jr* can use **Ashton-Tate's dBASE II** and **FRIDAY!** software packages, the company recently announced. The popular dBASE II package allows users to write their own application programs or to take advantage of the more than 750 user-developed dBASE II programs available from independent software marketers. FRIDAY! is a menu-driven data base management system based on dBASE II and intended for home or business. dBASE II—$700. FRIDAY!—$295.

ASHTON-TATE
10150 West Jefferson Blvd.
Culver City, CA 90230
213-204-5570

CIRCLE 483 ON READER SERVICE CARD

Also from **Ashton-Tate** comes **Multi-user dBASE II,** a version of dBASE II that enables users to create applications that allow more than one person to share information files. In addition, the system provides record and index lock-out capability, a feature that ensures only one user at a time can update information. $995 for purchasers without dBASE II; $295 for upgrade from dBASE II to four-user system; $495 for upgrade to eight-user system.

ASHTON-TATE
10150 West Jefferson Blvd.
Culver City, CA 90230
213-204-5570

CIRCLE 485 ON READER SERVICE CARD



Menlo Corporation has announced **In-Search,** a new software product that lets PC users easily obtain access to the more than 200 on-line data bases offered by Dialog Information Services Inc. These data bases contain more than 80 million articles and references from thousands of sources, including newspapers, magazines, and directories. $399.

MENLO CORPORATION
4633 Old Ironsides Drive
#400
Santa Clara, CA 95050
408-986-0200

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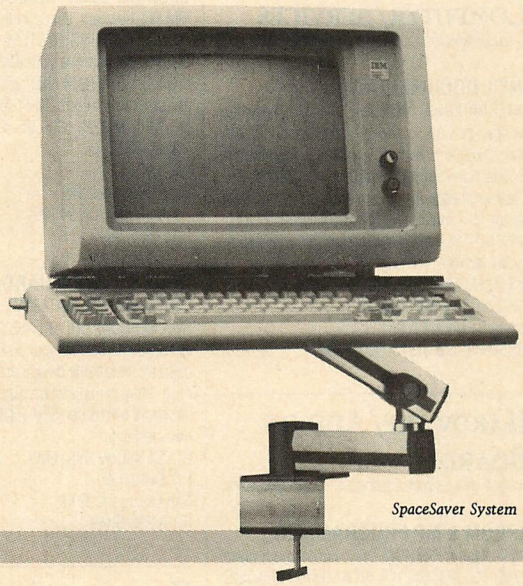
The PROFILER, from **DWB Associates,** is a software development tool designed to help the programmer create faster and more efficient programs by allowing him to determine where his program is spending the most CPU time. The PROFILER "samples" the instruction pointer at a fixed interval. It allows the programmer to "partition" the memory into as many as 16 different areas, each from 1 byte to 1 megabyte in size. The PROFILER then monitors the CPU registers while the program is running and prints (on the monitor or a diskette file) a report of the number of times the system was "caught" in each of the partitions. $129.95.

DWB ASSOCIATES
P.O. Box 5777
Beaverton, OR 97006
503-629-9645

CIRCLE 486 ON READER SERVICE CARD



Professional BASIC



SpaceSaver System

Morgan Computing Company has announced **Professional BASIC,** a version of BASIC that can access the full memory of the IBM PC. Professional BASIC is a 16-bit language that can use the 8087 coprocessor. The language includes a window-oriented system of more than a dozen tracing and debugging screens. The user is able to view changes in variables or array elements, progress of FOR/NEXT loops or GOSUBS, and more. The values of each variable are displayed at every point during execution of the program while it is running at slow speed. $345.

MORGAN COMPUTING COMPANY
10400 N. Central Expressway
Suite 210
Dallas, TX 75231
214-739-5895

CIRCLE 487 ON READER SERVICE CARD

BASIC compiler support for DataBurst, an IBM PC program generator with a full-screen processor, is now available from **Key Solutions, Inc.** This new option enables programmers to expand and test BASIC programs using the interpreter and then compile them with no changes. The compiler support is loaded into memory once and becomes an extension of the operating system. $40 for compiler support; DataBurst is $225.

KEY SOLUTIONS, INC.
P.O. Box 2297
Santa Clara, CA 95055
408-554-6125

CIRCLE 488 ON READER SERVICE CARD

Network Research Corporation has implemented the ARPA Internet Protocols (TCP/IP) in its **FUSION Version 2.0** Ethernet networking software, in addition to the Xerox XNS protocols currently included. FUSION Version 2.0 is a high-performance networking software system running on an Ethernet local area network. The first vendor-independent networking software program, FUSION can link 68000, VAX, PDP-11, and IBM PC processors using UNIX, MS-DOS, and VMS operating systems and network hardware from most LAN vendors. Prices vary from $750 to $1,250 for software, depending on the processor and operating system, and from $1,500 to $2,500 for the hardware.

NETWORK RESEARCH CORPORATION
1964 Westwood Blvd.
Suite 200
Los Angeles, CA 90025
213-410-3912

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OTHER WARES

A new idea for saving desk space has emanated from the **Omnium Corporation** in the form of a steel arm that attaches to the PC monitor and keyboard, allowing them to swing away from the desk. **The SpaceSaver System** is a counterbalanced arm constructed of brushed aluminum and black-enameled steel. It can be secured on any work surface with a maximum thickness of two inches and minimum overhang of two inches. The arm's platform supports any monitor weighing less than 50 pounds. It swivels 360 degrees. $499.

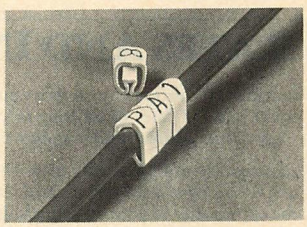
OMNIUM CORPORATION
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Stillwater, MN 55082
612-430-2060

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Partex has an answer to those unidentified cables and wires leading into and out of computers. The Swedish manufacturer offers a line of **preprinted markers** of three types. A sleeve marker can be used on non-terminated wires; the clip-on type can be applied to wires already installed or connected; and the cable tie can be fitted over a bundle of wires that are fastened together. The markers come in white or high-visibility yellow with permanent black text. They will fit most wire and cable sizes in the United States. Prices vary according to volume.

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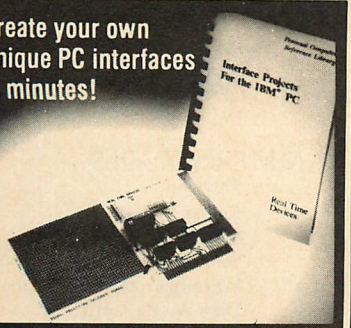
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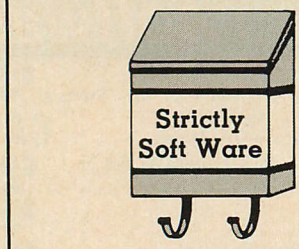
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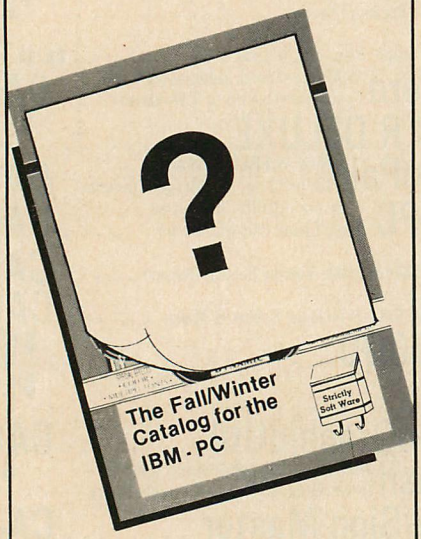
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JUNE

June 12-15
USENIX Conference
Hotel Utah, Salt Lake City
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June 20-22
SIGPLAN 84: Symposium on Compiler Construction
Hyatt Regency Hotel, Montreal
Sponsor: ACM SIGPLAN
Contact: ACM, 11 W. 42nd Street, New York, NY 10036

June 20-22
International Conference on Computers and Applications
Beijing (Peking), China
Sponsor: CIE Computer Society, IEEE
Contact: IEEE, P.O. Box 639, Silver Spring, MD 20901

June 21-23
Great Southern Computer Show
Jacksonville, FL
Contact: Great Southern Computer Shows, P.O. Box 655, Jacksonville, FL 32201, 904-356-1044

June 23-25
MEDCOM: National Conference on Computers in Medical Practices
San Francisco, CA
Contact: 800-445-2121 (California); 800-468-2211 (elsewhere)

June 26-28
PCExpo
New York, NY
Contact: PCExpo, 333 Sylvan Ave., Englewood Cliffs, NJ 07632, 201-569-8542

June 26-28
DENTCOM: National Conference on Computers in Dental Practices
San Francisco, CA
Contact: 800-445-2121 (California); 800-468-2211 (elsewhere)

June 26-29
Government Computer EXPO 84
Sheraton Washington Hotel, Washington, DC
Contact: US Professional Development Institute, 1620 Elson Road, Silver Spring, MD 20903, 301-445-9588

JULY

July 3-5
PC USER Show
London
Contact: EMAP International Exhibitions Ltd., Geoff Dickinson, 8 Herbal Hill, London EC1B 1PA, 01 837 3699

July 9-12
National Computer Conference
Las Vegas, NV
Sponsor: AFIPS
Contact: 1815 N. Lynn St., Suite 800, Arlington, VA 22209, 703-558-3620

July 23-27
SIGGRAPH '84: Eleventh Annual Conference on Computer Graphics and Interactive Techniques
Minneapolis, MN
Sponsor: ACM-SIGGRAPH in cooperation with IEEE Technical Committee on Computer Graphics, Eurographics, the Minneapolis College of Art and Design, the University of Minnesota, and the Science Museum of Minnesota.
Contact: SIGGRAPH '84 Conference Office, 11 East Wacker Drive, Chicago, IL 60601, 312-644-6610

AUGUST

August 2-5
Tampa Bay Computer Show
Tampa, FL
Contact: CompuShows, 800-368-2066

August 21-24
1984 International Conference on Parallel Processing
Bellaire, MI
Sponsor: Ohio State University and IEEE
Contact: Conference on Parallel Processing, IEEE Computer Society, P.O. Box 639, Silver Spring, MD 20901

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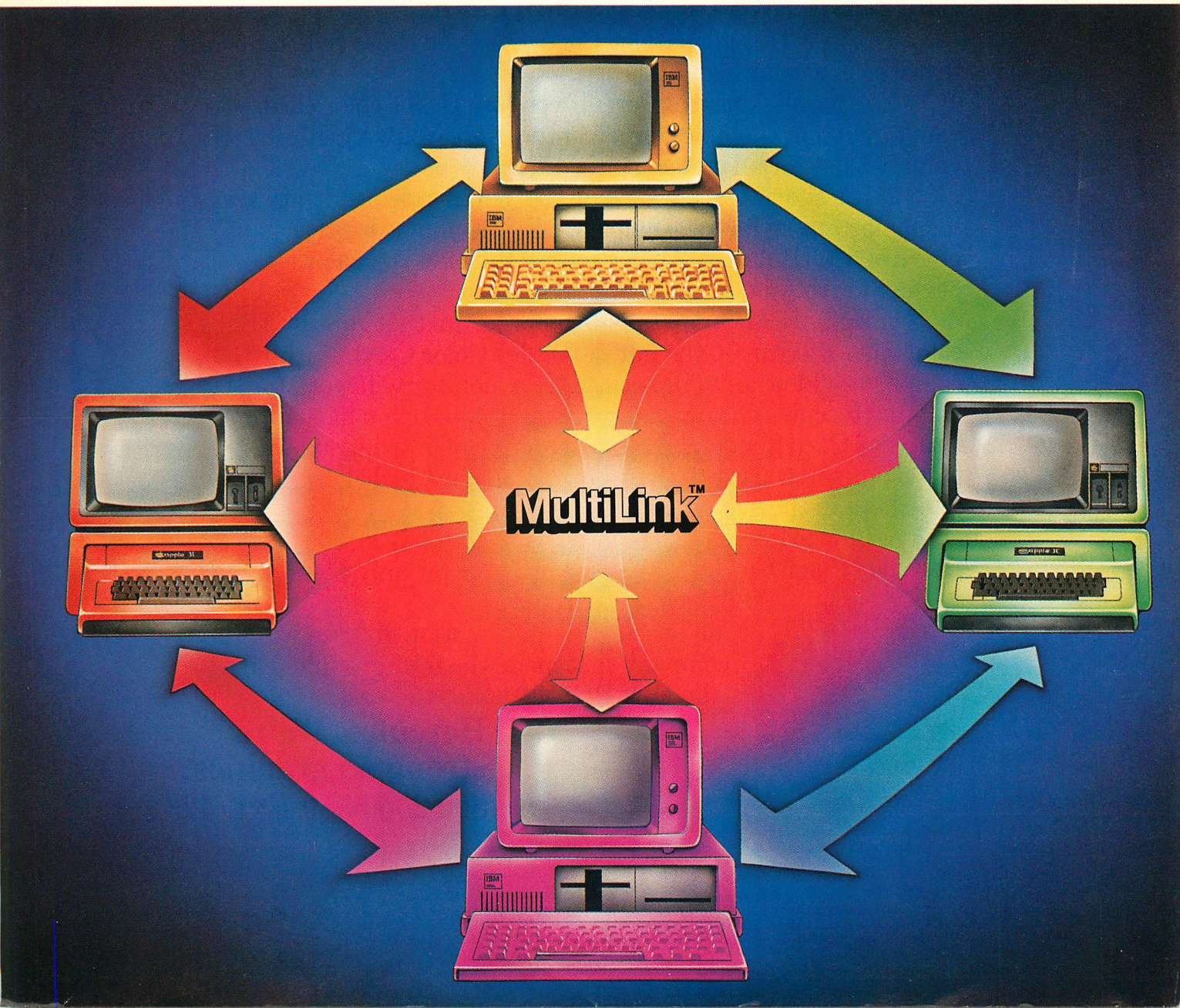
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